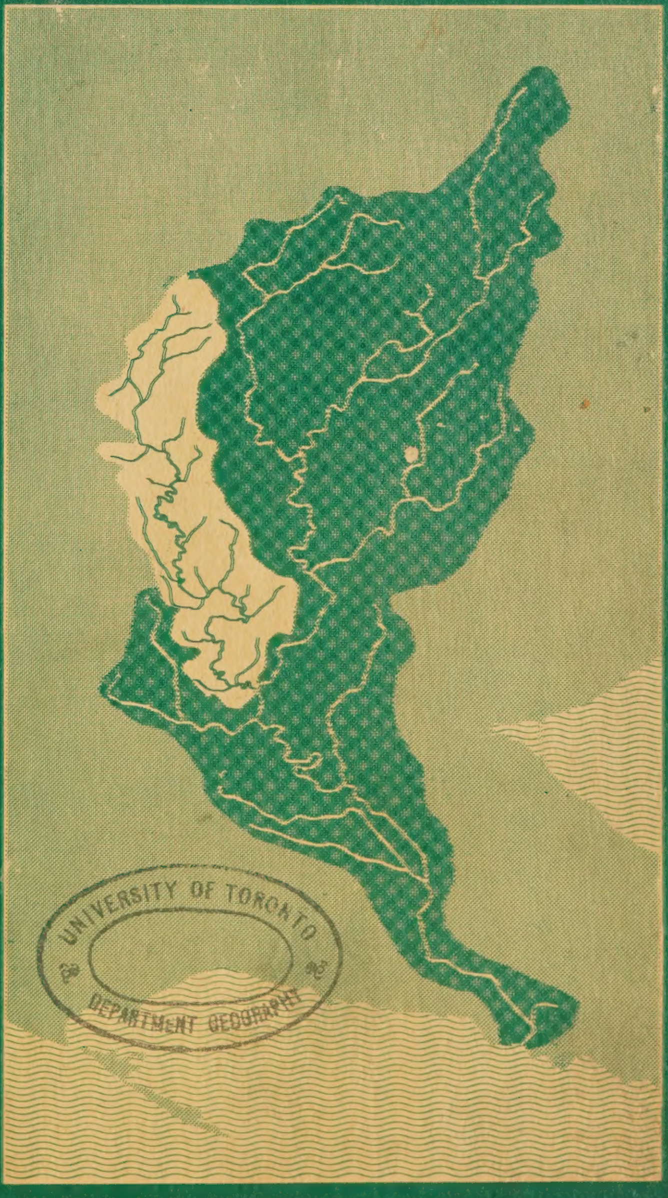
NITH VALLEY CONSERVATION REPORT

1951

DEPARTMENT OF PLANNING & DEVELOPMENT



Our humble servant of the bovine race
The docile cow, the ox, the patient steer
With slow and clumsy gait and gentle face,
In our domestic life, without a peer.

Good things provide where'er our table's set
The golden spread, the flowing glass, and cheese
For lunch, and then our fruit with cream we wet,
Or roast of beef, or steak with palate please.

All flesh is grass (and clover we allow)
All good things that we eat the soil does give,
So must we nurture soil, and grass and cow
And tend them with great care that we can live.

The cow, the grass, the clovers and the soil
Well husbanded, will well repay our toil.

—Angus Meadowbrook.

DEPARTMENT OF PLANNING AND DEVELOPMENT

The Honourable Wm. Griesinger, Minister

A. H. RICHARDSON, Chief Conservation Engineer

NITH VALLEY (INTERIM) CONSERVATION REPORT

ONTARIO

TORONTO

1951

Four hundred copies of this
Report have been prepared,
of which this is

Number 184

Honourable William Griesinger, Minister,
Department of Planning and Development,
Parliament Buildings,
Toronto, Ontario.

Honourable Sir:

I take pleasure in transmitting herewith an Interim Conservation Report on the Nith Valley, which is part of the Grand River Watershed.

The Report is in four sections: Geography, Forestry, Water and Wildlife.

Yours very truly,

A. H. Richardson,
Chief Conservation Engineer

Toronto, April 16, 1951

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ACKNOWLEDGEMENTS

While the Interim Report on the Nith Valley was prepared by the staff of the Conservation Branch of the Department of Planning and Development, University staffs and members of other organizations have contributed generously to the supplying of data.

We are grateful to Mr. I.C. Marritt, Galt District Forester and Mr. L.S. Hamilton, Zone Forester at Galt, for their assistance; Mr. W.G. Thurston of Stratford was most helpful in furnishing data on county forests and private reforestation; we also wish to thank the sawmill operators and superintendents of wood-using industries for their co-operation in supplying information used in the chapter on Sawmills in the Forestry section of the Report.

For their advice in the preparation of bird and mammal lists used in the Wildlife section of this Report we wish to thank Mr. J.L. Baillie and Mr. Stuart Downing, both of the Royal Ontario Museum of Zoology. Mr. F.H. Merner, Conservation Officer for Waterloo County, and Mr. James F. Gage, Huron District Biologist, also provided most valuable assistance in the field surveys.

We are grateful also to Mr. Wm. Haggart, Town Clerk, Paris, and Mr. Clayton Ingold of New Hamburg for information supplied by them concerning floods on the Nith River.

INTRODUCTION

During the summer of 1949 the Conservation Branch of the Department of Planning and Development carried out a conservation survey in the Nith River Valley. This was in accordance with the policy established by the Department, namely of making an appraisal of the conservation needs of a watershed after an Authority had been established. On most watersheds the initial survey has covered the whole area, but it was found impossible to do this on the whole Grand Watershed in one summer owing to its size; therefore, after consultation with the Authority, the Nith Watershed was selected as the part of this area to be dealt with first.

It will be noted further that this report is entitled an interim report because it covers only the problems of geography, forestry, water and wildlife. Certain studies were also made with respect to land use problems in Mornington and Blenheim Townships, but this material, which involves the preparation of several maps, has not been completed.

The section on hydraulics is intended only as an indication of what the problem of flooding is on the Nith River, but this has not been treated in full in this study because the Nith flood problems are a part of the over-all flood problems of the whole Grand River System and, independent of the work done on the Nith, the Conservation Branch is now engaged in preparing a complete hydraulic report for the Grand River System. On the other hand, the geography, forestry and wildlife sections are complete and, in addition to covering these subjects as in reports for other Authorities, a special study has been made of sawmills and wood-using industries within the Nith area.

In releasing this report to the Grand Valley Conservation Authority it is hoped that the Authority will see the need of certain remedial measures in conservation which should be undertaken on the Nith as soon as possible. In the

course of time the other watersheds which are included in the Grand Valley will be surveyed in like manner and the reports on these, together with the hydraulic report being prepared for the Grand River System, will provide a working plan for carrying out conservation projects over the whole area.

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RECOMMENDATIONS

RECOMMENDATIONS

STATED OR IMPLIED IN THIS REPORT

Forestry

1. That the Nith Forest of about 9,450 acres, comprising 17 areas of marginal and submarginal land, be established by the Authority to protect the natural water-storage areas of the watershed and make the best use of land which is suitable only for the growing of trees. p. 41

2. That the Authority endeavour to work out, with the Department of Lands and Forests, a fire protection scheme for all the woodland on the watershed, and prohibit the burning of refuse in the Ellice Swamp. p.52

3. That the Authority expropriate all tax delinquent land suitable for conservation purposes, subject to the regulations of the Municipal Act. p.64

4. That the Authority purchase one or more tree-planting machines which may be rented to private landowners and used to reforest both privately and publicly owned land. p.74

5. That reforestation of privately owned land be encouraged in every way possible, particularly on sandy, gravelly and poorly drained soils and on slopes too steep for agriculture. p.31

6. That the Authority consider a scheme to aid farmers in fencing their woodlots similar to that adopted by the County of Halton. p.49

7. That municipalities within the watershed be encouraged to establish small forests for demonstration purposes. p.36

8. That the Authority encourage schools to enter the Provincial School Forestry Competitions conducted by the Ontario Horticultural Association. p.39

9. That consideration be given to the problem of organized marketing of woodlot products in order to aid the farmer in finding the best market for them. p.55

10. That the Authority encourage and assist in every way possible the establishment of windbreaks, shelterbelts and snow fences because of their contribution to the reduction of soil erosion by lowering wind velocities, distributing snow more evenly and reducing evaporation. p.74

11. That the Authority request the Department of Lands and Forests to require all log buyers who purchase from Southern Ontario woodlots to publish their general log-grade specifications with prices for each grade. p.103

12. That the Authority request the Department of Lands and Forests to conduct a study with the object of standardizing hardwood log grades by classification of logs, based on defects, according to the useto which the log can be put. p. 101

13. That the Conservation Authority make direct representation to the Department of Finance of the federal government in support of the recommendation in the Report of the Select Committee on Conservation (1950) that "The Dominion Government should be asked to consider amending The Income War Tax Act so that landowners will no longer be penalized for cropping their timber in accordance with conservation practices". And that all interested landowners support this recommendation through their federal members and in every other way possible. p.92

14. That the Conservation Authority urge the Department of Lands and Forests to extend the Forest Resources Inventory, which is at present under way in Northern Ontario, to cover Southern Ontario. This should be followed as soon as possible by a study of growth rates and annual cut. p.83

15. That the Conservation Authority request sawmillers within the area to consider replacing the present practice of custom sawing by an arrangement whereby credit is given for "custom logs", and against this credit the farmer receives at special prices the species, quantity and quality of product best suited to his needs. p.89

16. That prior to the sale of timber the owner obtain from the office of the Zone Forester a list of buyers who might be interested in purchasing his product. p.94

17. That woodlot owners considering the sale of standing timber solicit tenders from as many buyers as possible who are within economical operating distance of the woodland. P.94

18. That in such sales the owner consider the advantages and disadvantages of both lump sum sale and stumpage rate sale. pp. 93 and 95

19. That the Conservation Authority prepare a model Timber Sales Contract for the guidance of woodlot owners. p.95

20. That woodlot owners be advised to enter into a written Timber Sales Contract for all sales of timber on the stump. p. 96

21. That the woodland owner be advised to consider carefully the advantages of having experienced cutters do the logging and that he handle small products such as fuelwood, posts and bolts himself. p.99

22. That the woodlot owner recognize the marking of trees for removal to be a technical operation important to the future of the woodlot; and that this marking be carried out on the advice of the Zone Forester or other trained personnel. p. 99

Water

23. That the proposed channel improvement at New Hamburg be implemented at an approximate cost of $81,500. p.9

24. That the forced road through Lot 18, Con. XIII, north of Plattsville be raised a maximum of three feet for a distance of about 700 feet at an approximate cost of $3,000. p.11

25. That the Ayr Dam and Reservoir be constructed for flood control and to provide increased summer flow. p.8

26. That the Nithburg Dam and Reservoir be constructed to provide a greater degree of flood protection and increased summer flow. p.8

27. That the Authority assist in establishing demonstration farm ponds and that these be distributed according to the map of recommended pond regions which accompanies this report. p.28

Wildlife

28. That the Authority encourage farmers to improve land for wildlife by the elimination of grazing of woodlots, by selective rather than clear-cutting of woodland, by improved cultivation practices and by the planting of wildlife food patches. p. 18, 19

29. That the state and trend of meadow mouse populations be examined in areas scheduled for reforestation in the fall of the year of planting and regularly each fall for at least five years after; and that research be carried out to discover adequate repellent washes for the protection of orchard and forest trees from the meadow mouse and the European hare. p. 17, 27

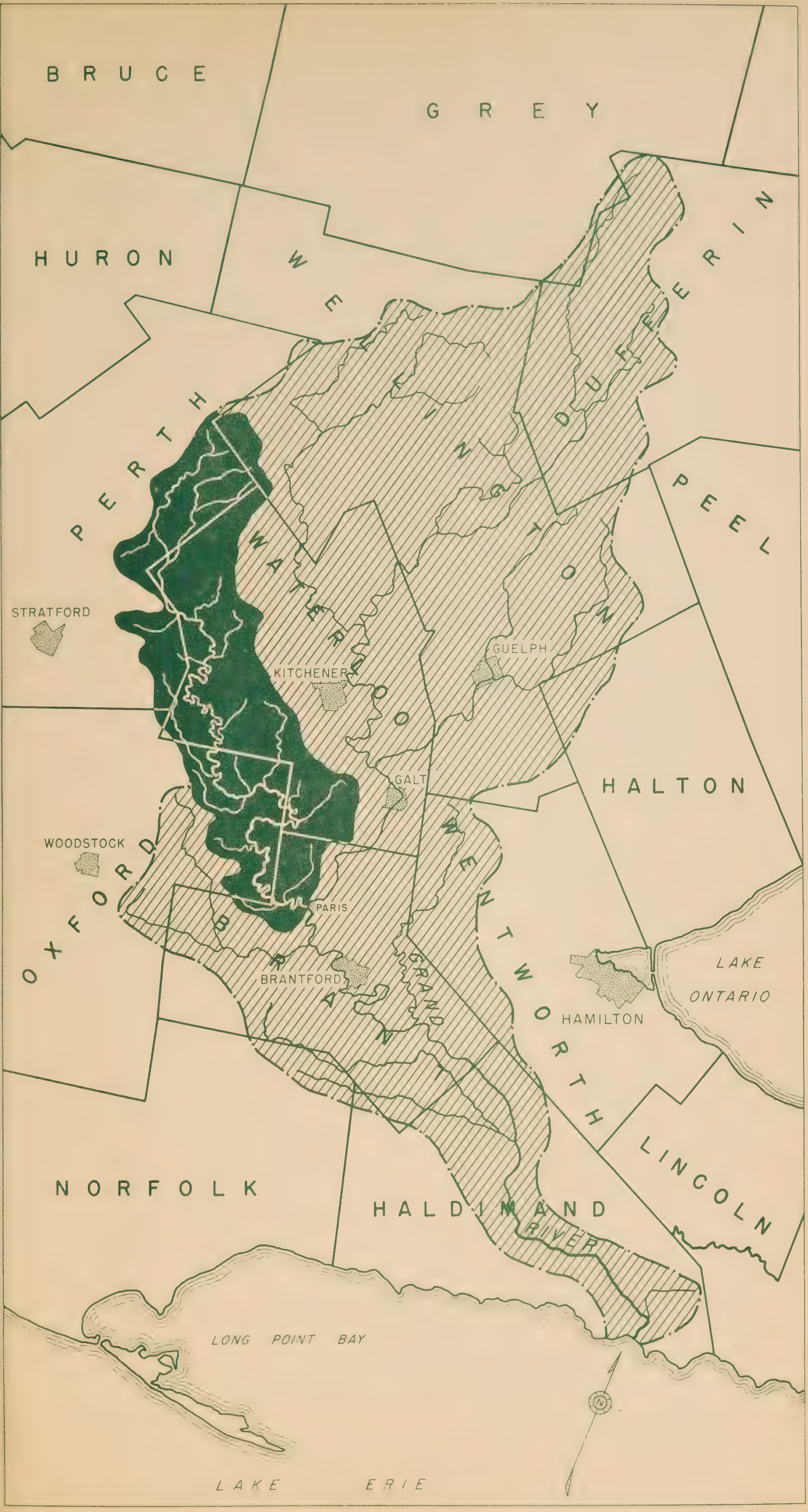
30. That the fishing in the watershed be improved by the following methods:

(a) Encouragement of owners of spring creeks to extend the range and abundance of speckled trout by planting alders along the stream banks and by constructing trout ponds near the sources. p. 39

(b) Encouragement of farmers to construct and maintain warm water ponds for the production of fish. p.41

31. That the introduction of fish into the watershed be restricted to those parts of the river shown on the map "Biological Conditions of Streams" to be suitable for the species concerned. p.32

GEOGRAPHY


BRUCE
GREY
HURON
WELLINGTON
DUFFERIN
PERTH
PEEL
STRATFORD
WATERLOO
GUELPH
KITCHENER
HALTON
GALT
WOODSTOCK
OXFORD
PARIS
WENTWORTH
BRANT
BRANTFORD
GRAND RIVER
LAKE ONTARIO
HAMILTON
LINCOLN
NORFOLK
HALDIMAND
LONG POINT BAY
LAKE ERIE

CHAPTER 1

PHYSICAL GEOGRAPHY

1. Location and Boundaries

The Nith rises in Maryborough Township in Wellington County and Mornington Township in Perth County, flows through Wellesley and Wilmot, Blenheim and the Dumfries to join the Grand River at Paris. In all, eighteen townships in five counties have some of their land drained by the Nith and its tributaries. The total area of the watershed, or land drained by the river, is 432 square miles or over 275,000 acres.

2. Geology

The bedrock of the area is covered by some hundred or more feet of unconsolidated mineral material of glacial origin, called drift, and for this reason has little direct effect on the surface relief. It has, however, two indirect effects on the physical geography of the watershed. The surface altitudes of South-western Ontario correspond roughly to the south-westerly slope of the bedrock and the drainage of the Thames and Grand river systems are directed westward and southerly to conform to this slope. The bedrock materials are predominantly limestone and shale so that the soil materials tend to be clayey and to have a high proportion of lime in them.

Except for the south-westerly slope, the bedrock lies generally flat with no faulting or warping to disturb the land surface. The surface relief is entirely the result of the glacial deposits. Nowhere on the watershed are there rock outcrops or quarry workings of significant commercial value.

The bedrock formations[1] are sedimentary strata

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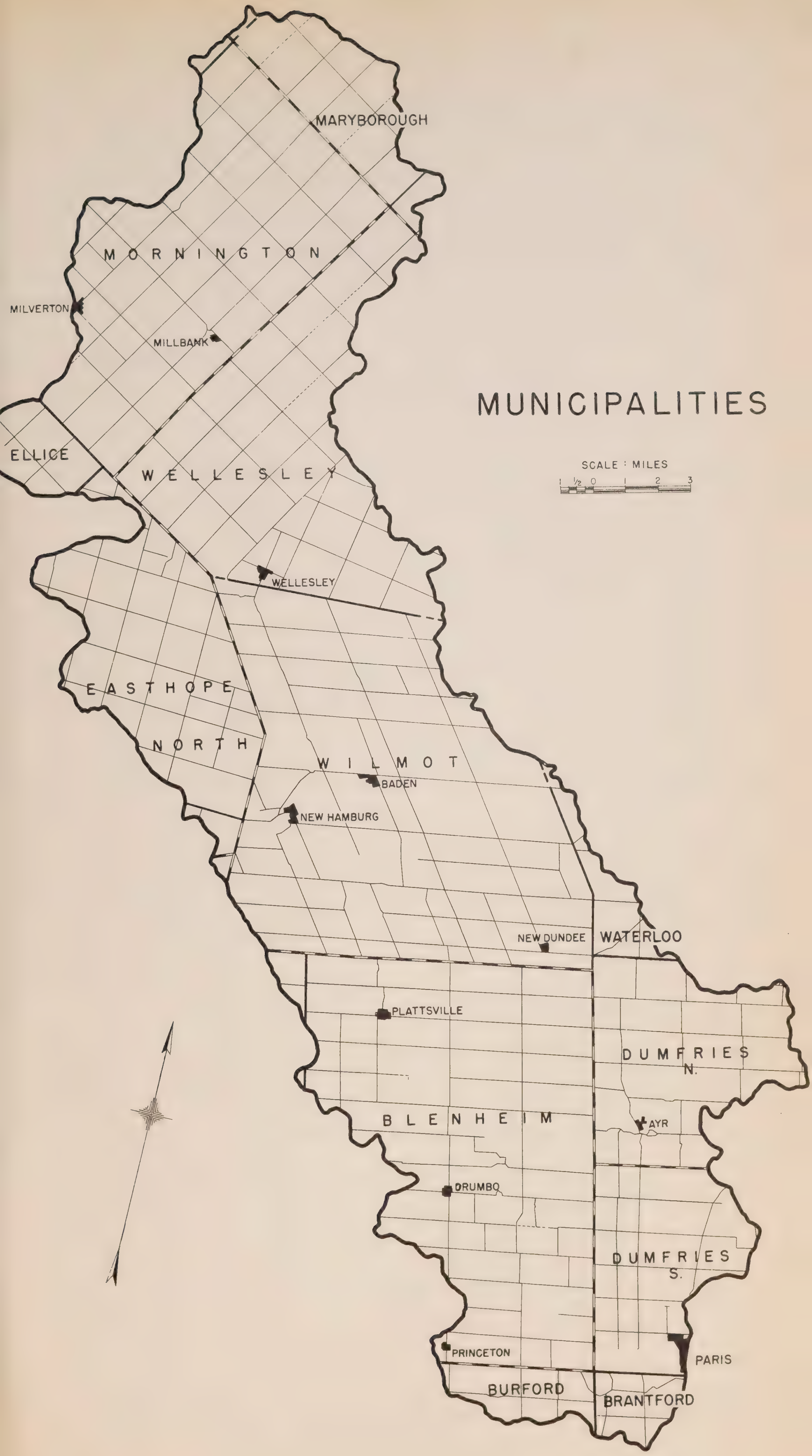
1. Caley, J.F. Palaeozoic Geology of the Brantford Area. Geological Survey, Memoir 226.



MUNICIPALITIES
SCALE : MILES
1 1/2 0 1 2 3
MARYBOROUGH
MORNINGTON
MILVERTON
MILLBANK
ELLICE
WELLESLEY
WELLESLEY
EASTHOPE
NORTH
WILMOT
BADEN
NEW HAMBURG
NEW DUNDEE
WATERLOO
PLATTSVILLE
DUMFRIES
N.
BLENHEIM
AYR
DRUMBO
DUMFRIES
S.
PRINCETON
PARIS
BURFORD
BRANTFORD

of the Silurian and Devonian systems. The greater part of the watershed is underlain by rocks of the Salina formation. This is described as consisting of brown dolomite, shaly dolomite, limy shale and gypsum. The western portion is underlain by rocks of the Norfolk formation which are largely limestone.

3. Physiography

The surface relief of the watershed is the result of glaciation, erosion by post-glacial streams and dissection by the present surface drainage system. Physiographically the watershed is a portion of a larger, more complicated system of glacial land forms covering peninsular Ontario[1].

The unconsolidated material has been deposited over bedrock by at least three advances of the glaciers which, in the past million years, covered the northern part of the continent. The total depth of material is over one hundred feet and was built up by successive glaciations, but the existing land forms are largely the result of the last glaciation, called the Wisconsin. Four types of land forms of glacial origin can be recognized. These are till plain, end moraine, kame moraine, and meltwater channels. They largely determine the form of the rivers and the types of the soil.

The till plain is formed by deposition under a moving mass of ice. The material is clayey with some stones and boulders and the resulting relief is undulating to rolling. An end moraine is a hummocky ridge pushed up at the face of the glacier; the material may be clay or loam with boulders and the relief is generally rougher than the till plain. Kame moraines are ranges of very hummocky hills composed of roughly stratified sands and gravels which were deposited by meltwater near the edge of a decaying ice mass. Broad valleys

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1. Chapman, L.J. and D.F. Putnam. The Physiography of Southwestern Ontario. Scientific Agriculture. 24:3, November 1943.

mark the channels cut by the great volume of meltwaters from the glaciers. The main streams now flow in these channels but carry much less water than the flow which cut the valleys. Some of the channels are almost abandoned and are merely filled with swamps.

4. Climate

The climate of the watershed can be fairly well described from weather records of stations at Paris, Kitchener, Stratford and Elora. Most of the area lies within a climatic region called by Putnam and Chapman the "Western Uplands"[1]. The southern part of the watershed, at elevations below 1,000 feet, is in a region called the "South Slopes" which includes York, Peel and Halton through to Oxford.

The main features of the climate are those common to the lower Great Lakes region. The local features are due to latitude and more particularly the altitudes of the South-western Ontario uplands and the west-facing slope of the land.

The effect of elevation is noticeable from south-west to north-east and the effect of latitude can be seen in the extreme north and south parts. The Western Uplands are described as follows:

> "The most elevated part of Southern Ontario, ranging from 1000 to over 1700 feet, comprises parts of Wellington, Waterloo, Perth, Huron, Bruce, Grey and Dufferin counties. On the north and east it presents faces of sharp relief, but slopes gradually into the adjoining regions on the south and west. Climatically it is not homogeneous, for at some season of the year the outlying portions differ less from the adjoining regions than they do from the central and more elevated parts.
>
> The mean annual temperature ranges from 41° to 44° and is equivalent to that of the Kawartha Lakes or Eastern Ontario. The winter temperatures of 18° to 21° are, in the main, equivalent to those of the Kawartha region but spring temperatures of 37° to 40° are definitely cooler. Summer temperatures of 64° to 65° are about 1° below those of adjoining areas. Fall temperatures vary from 45.5° to 48°. The region has an extreme temperature range of 145°, from -43° to 102°. The mean daily range for the year is 19° to 21°

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1. Putnam, D.F. and L.J. Chapman. The Climate of Southern Ontario. Scientific Agriculture. 18:8.

with as much as 26° in July. The frost-free season of 125 to 140 days is much the same as that of Eastern Ontario, being nearly a month shorter than in the milder parts of the adjoining shore regions. The growing season varies from 180 to 195 days, being shortest in the most elevated part of the region.

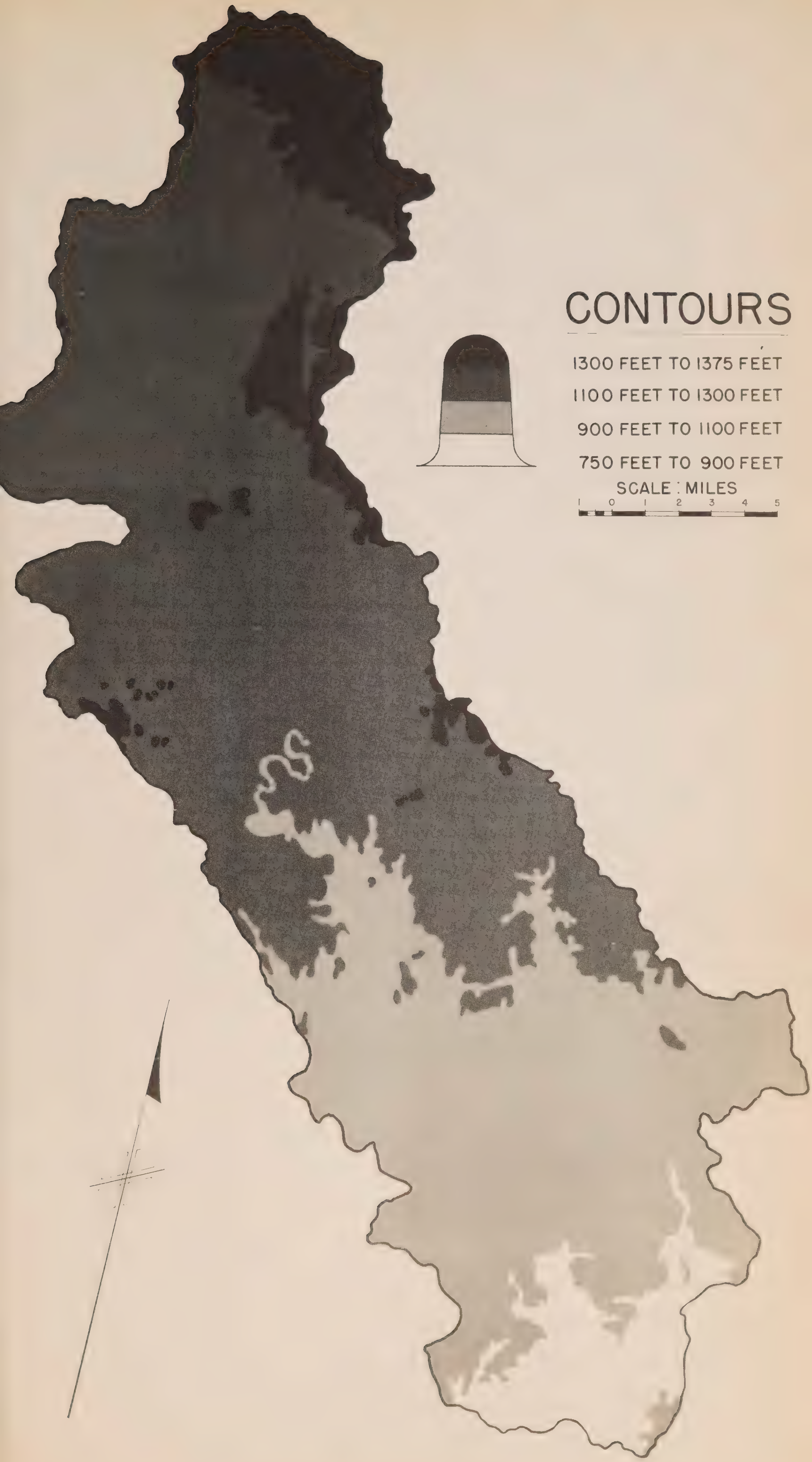
The western side of the region has a heavy precipitation, 38 inches annually, decreasing eastwardly to about 32 inches. It is interesting to note that it is not the most elevated area that receives the most rain, but rather, that part having a westerly slope. Snowfall varies from 80 to 125 inches, being heaviest northward. The area of high summer rainfall lies on the southern border of the uplands, receiving from 16 to 18 inches between April 1 and September 30, or about the same as eastern Ontario. Between 8 and 9 inches of rain is received in the months of June, July and August. The uplands are less subject to drought than most of the adjoining areas, having an average frequency of about 18, which, however, is considerably greater than that of eastern Ontario or Muskoka, both of which have about the same amount of precipitation. The P-E index for the three summer months is 12.0 to 14.5, indicating that this is to be regarded as a moderately humid region."

Reference to change in forest cover types as related to climate is given in the Forestry section. There is a marked change in land use from south to north, largely controlled by climate, and to some extent exaggerated by change in soil types. Corn cribs and tobacco fields are common in the light soils of the south; comparatively small acreages of wheat and silage corn are noticeable features of the clay soils of northern headwater regions.

5. The River System and Drainage

The river has its source in land at an elevation of 1,375 feet. The level at its juncture with the Grand River is about 750 feet. At New Hamburg the elevation is about 1,075 feet. The average gradient is a little over five feet in the mile, but for a few miles near its source and also above Paris it runs a little steeper.

The main stream rises in Mornington Township and flows through Nithburg, New Hamburg and Ayr. It is joined throughout its length by a number of branches, each of which has a number of smaller tributaries. In the flat and undulating clay lands, particularly in the north, many of the tributary streams have been channelized by digging and straightening.


CONTOURS
1300 FEET TO 1375 FEET
1100 FEET TO 1300 FEET
900 FEET TO 1100 FEET
750 FEET TO 900 FEET
SCALE : MILES
1 0 1 2 3 4 5

The gradients of the short lateral tributaries are much greater and the fall in land towards the river averages as high as 85 feet per mile where the slopes are steep.

Geologically the river system is very young, ten or twenty thousand years old. The streams are still cutting into the relatively soft material and are cutting back by "headward erosion". The direction of the streams is largely determined by the surface relief as it was moulded by the glacier. The generally flat land of the head-water region is incompletely drained, partly because of the compact nature of the soil, partly because the river system is so immature and has not tapped the flat ground.

The normal geological cycle of erosion has been speeded up during the period of agricultural settlement. This is partly due to the removal of trees, partly to the change in the soil under cultivation and partly to the straightening of stream channels and digging of ditches. Except that in so far as some ditches provide outlet for tile drainage there is apparently little advantage in a good deal of ditching, but run-off is accelerated locally with increased flood hazard, and rapid headward erosion causes serious gullying and cave-ins. Much of the land of the watershed is still limited in its capacity to carry crops because of imperfect drainage.

6. Soils

The soils of the watershed have been formed on glacial deposits in a cool moist climate under hardwood and mixed forests. They belong to the great soil group, the Gray-brown Forest soils. Differences are due mainly to the variety in parent mineral material (of glacial origin) and degrees of natural internal drainage. Similarity due to common climate and vegetation is strengthened by a fairly uniformly high proportion of lime in the parent materials. (The proportion of lime and the "reaction" of the soils vary from type

to type.)

The soil types of the area are described in publications of the Ontario Soil Survey and soil maps of Perth, Waterloo, Oxford and Wellington have been made by the Survey.

The most important soil types found on the watershed are here described very briefly. They include

(a) Huron clay loam
(b) Perth clay loam
(c) Brookston clay loam
(d) Guelph loam
(e) London loam
(f) Dumfries loam
(g) Fox sandy loam
(h) Waterloo sandy loam
(i) Berrien sandy loam

(a) Huron clay loam is a heavy-textured soil with horizons well defined. The topsoil is loamy and the subsoil is a brown clay with a fairly open nut structure. The relief is undulating to rolling and drainage is good both within the soil and on the surface. It is found on end moraine and till plain land forms.

This is a fertile soil of high capability. Under poor cultivation or overgrazing it is subject to compaction. On slopes it is subject to erosion.

(b) Perth clay loam is the imperfectly drained soil associated with the Huron. It lies in broad stretches where the land is flat and is found in small patches in low-lying areas. It can be recognized by the gray mottling in the brown subsoil.

This is also a fertile soil but limited in its range of crops due to inadequate drainage. Although found on gentler slopes than Huron it is subject to erosion and possibly more subject to compaction.

(c) Brookston clay loam is the poorly drained associate of Perth and Huron, found in depressions and broad level stretches. It requires intensive underdrainage to carry a full range of crops. Much of it is used only for hay and grazing.

(d) Guelph loam is found on till plain and moraine land forms and is a loamy soil with good mixture of clay, silt and sand, with some stones and boulders. Horizons are well defined and the subsoil is a deep, brown nut-structured loam.

The relief is undulating to rolling. Drainage is good. This is a soil of high capability which is intensively used and consequently quite susceptible to erosion. Where topsoil is eroded from knolls and slopes the exposed subsoil is often mistaken for clay loam.

(e) London loam is the imperfectly drained associate of Guelph loam, found on flat land, depressions or areas with poorly developed surface drainage. It is recognizable by its gray mottled subsoil. When adequately drained artificially it is a soil of high capability which can carry the full range of meadow crops and legumes, small grains and corn.

(f) Dumfries loam is a coarse, stony soil generally found on rough, irregular slopes. The horizons are well defined, the subsoil is a reddish-brown loam of varying depth. On steep slopes it is subject to erosion. Inherent fertility is much lower than that of the previously mentioned soils.

(g) Fox sandy loam is a light-textured, open, sandy soil. When not eroded the topsoil is quite deep and underlain by a shallow bright brown subsoil. The parent mineral material is a yellowish-gray sand. This soil is more acid in reaction than the heavier soils.

Because it is easy to cultivate, this soil has generally been intensively used in the past and suffers from mild erosion and serious depletion of organic material (humus). It is often used for specialized crops, including tobacco.

(h) Waterloo sandy loam is an open sandy soil with both topsoil and subsoil well developed. It is generally found on steeply sloping relief and has been eroded considerably. The good or excessive drainage and open texture promotes quick

oxidation of organic matter and leaching of fertilizer, so that the soil only retains high capability under very good management.

(i) Berrien sandy loam is a light soil underlain by clay or clay loam at two to five feet, which restricts the internal drainage. To the extent to which water is held this soil has a little higher capability than the Fox soils which it otherwise resembles.

Other soils found on the watershed, in smaller areas than those described above, are:

Parkhill loam - the poorly drained associate of Guelph.

Harriston and Listowel loam - the well drained and imperfectly drained soils respectively of an association similar to the Guelph - London but differing in having a more yellow-coloured subsoil.

Burford, Brisbane and Gilford loam - gravelly soils, the well, imperfectly and poorly drained members of an association of soils formed on gravels and silts deposited by glacial meltwaters.

Muck is deep organic soil overlying sticky subsoils in very poorly drained locations.

Bottomland is soil found on valley bottoms subject to annual flood.

CHAPTER 2

HUMAN GEOGRAPHY

1. Land Use

The main land use of the area is agriculture of a mixed dairy type. Some farms are set up for beef production on the grazing areas, particularly in the north. In the southern part of the area some specialized cropping is carried out, including the growing of tobacco. Commercial logging in woodlots is not carried on over any large area. The improved land includes considerable areas of pasture and the rest is cultivated for grass and legume mixtures, grains, corn and some roots. The proportion of land in grain and corn diminishes towards the north where there is a larger area in pasture.

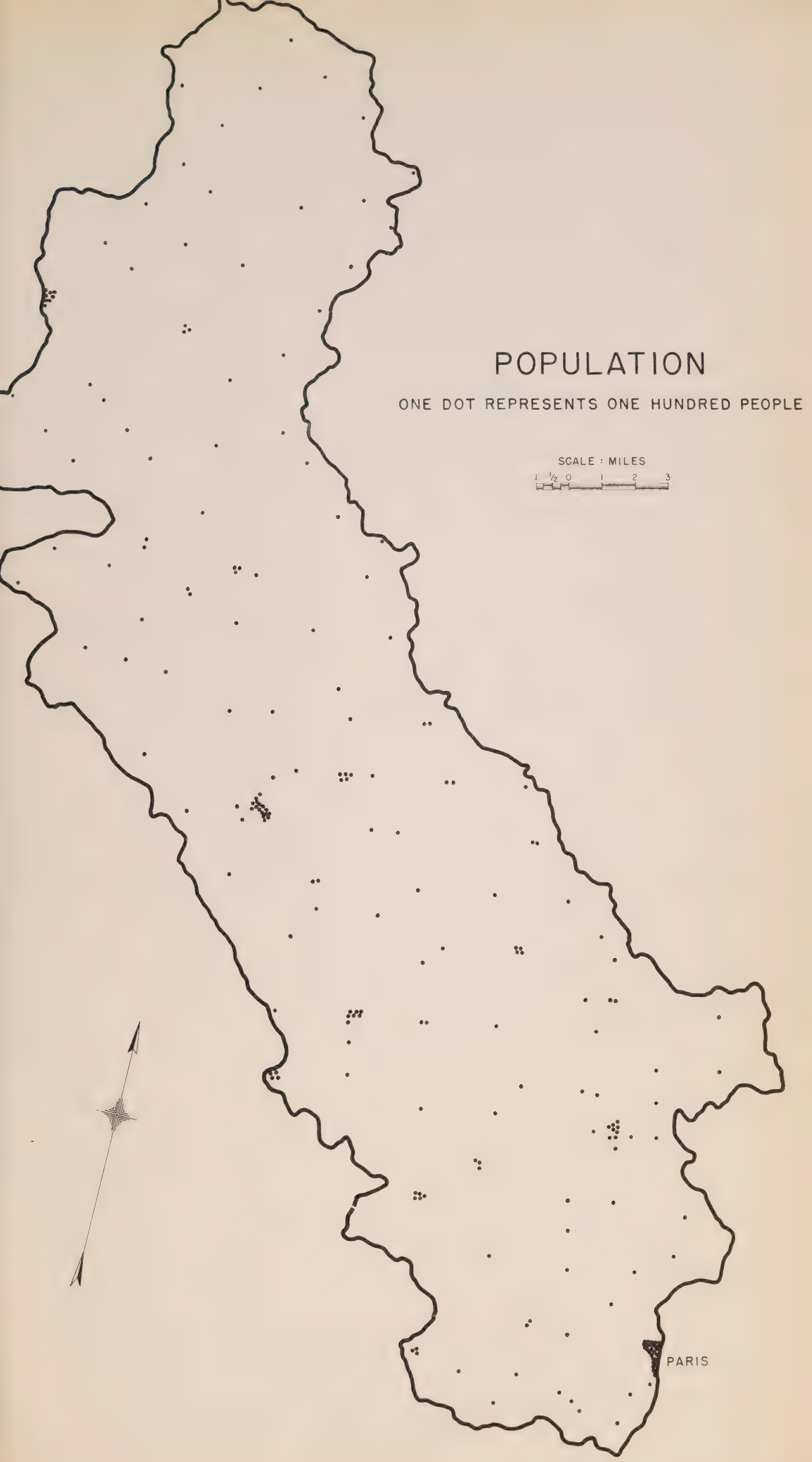
Milk produced in the area goes largely to creameries and cheese factories which are found throughout the area. Pork, beef and poultry find outlet in Kitchener packing plants. Mills in the towns and villages absorb whatever grain is not processed and used on the farm.

The following account of land use is taken from the 1941 Census of Canada.

In Mornington Township about 10 per cent of the land is wooded, waste or natural pasture. Of the improved land about 65 per cent is in field crops, 25 per cent in pasture and the remainder is in fallow and other uses. In Blenheim at the lower end of the watershed about 25 per cent is wooded or waste-land. (This is due to the large swampy areas in the meltwater channels.) Of the improved land about 20 per cent is in pasture and nearly 80 per cent is in field crops.

2. Urban Centres and Industries

The twin cities of Kitchener and Waterloo provide the urban centre for the region of which the watershed is a part. These cities have a great diversity of industries and also function as the commercial and financial centre for the area.


POPULATION
ONE DOT REPRESENTS ONE HUNDRED PEOPLE
SCALE : MILES
1 ½ 0 1 2 3
PARIS

The only city actually in the watershed is Paris, but as this is situated at the mouth of the river only the lower part of the watershed is affected by it. Galt lies just to the east of the watershed but it serves as the administrative centre for Waterloo County, in which much of the watershed lies.

Other important centres lie within the watershed. These include Milverton, Millbank, New Hamburg, Baden, Ayr, Wellesley, Plattsville, New Dundee and Drumbo. These function as commercial centres for the area, process, store and ship agricultural and forest products, provide local services such as garages and repair shops and have some industries as well. Smaller centres such as Nithburg and Washington have local significance.

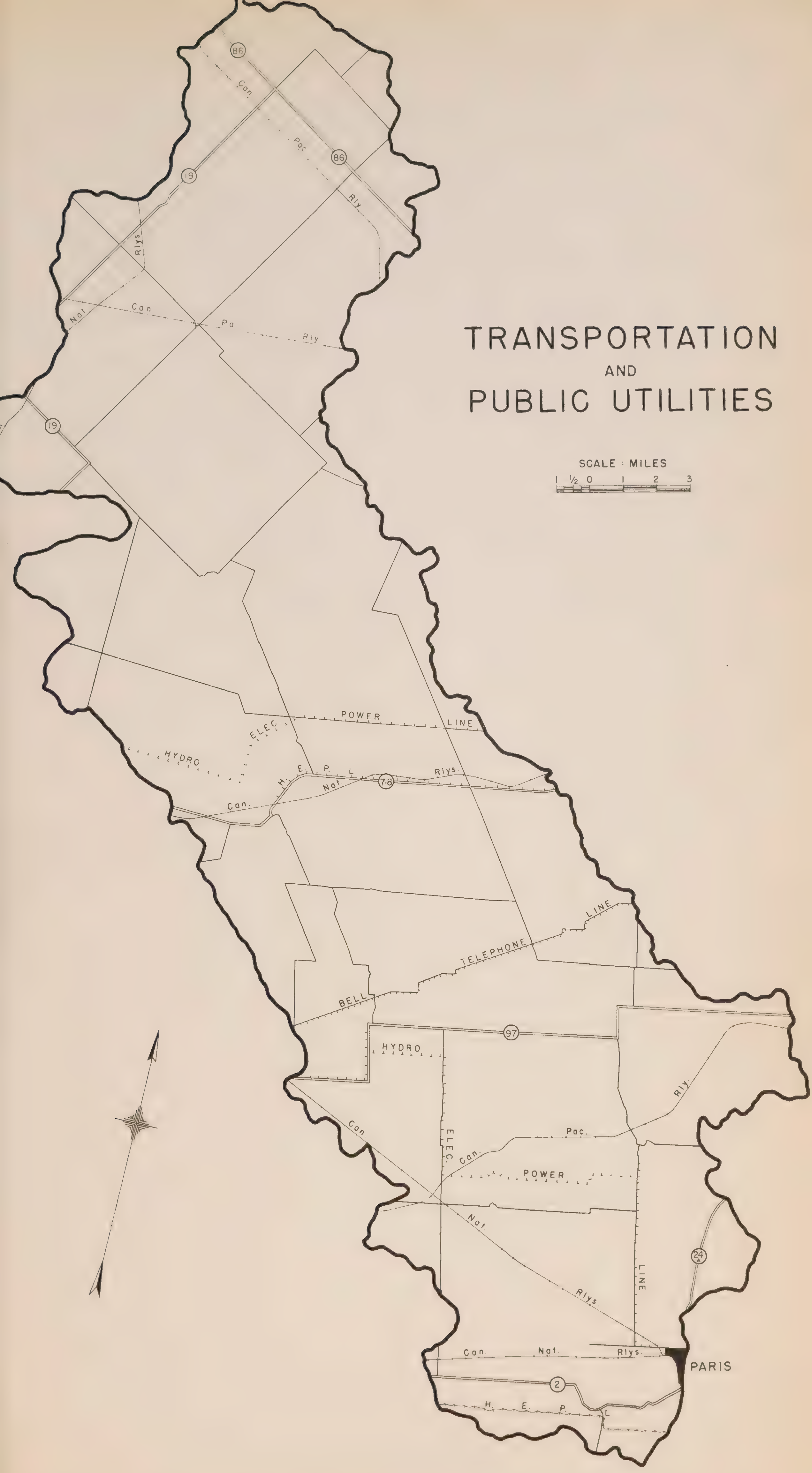
Three railway lines traverse the area from east to west, running roughly parallel about twelve to fifteen miles apart. Milverton, New Hamburg and Ayr are each on one of the lines. A main provincial highway, No. 7, runs east and west across the middle of the watershed.

3. Population

Rural population is concentrated in the southern townships and in the areas flanking No. 7 Highway. Farm population is less dense in the northern areas of the watershed. The rural population tends to remain at a fixed level but there is some increase, and a proportional increase in building, in the larger centres as industries become established.

4. History

Settlement of the watershed by white people began about the year 1800. By 1820 there were a number of settlements established with mills at various centres. Some of the first land settled was bought from the Six Nation Indians who had been granted a tract. A group of German-speaking Mennonites from Pennsylvania formed a land company and brought in settlers fairly quickly. Many of their descendants still live in the watershed and the area occupied by them is increasing.


TRANSPORTATION
AND
PUBLIC UTILITIES
SCALE : MILES
1 1/2 0 1 2 3
86
Can.
Pac.
86
Rly
19
Rlys
Nat
Can
Pa
Rly
19
POWER
LINE
ELEC.
HYDRO
H. E. P. L
Rlys.
Nat.
7-8
Can.
LINE
TELEPHONE
BELL
97
HYDRO
Rly.
Pac.
Can.
ELEC.
Can.
POWER
Nat.
24A
LINE
Rlys.
Can.
Nat.
Rlys.
PARIS
2
H. E. P. L

The Dumfries Townships were developed after 1816 and settled largely by Scottish immigrants. Place names and family names give evidence of this early settlement.

Wellesley Township began to be settled about 1830 by sale of the Clergy Reserves.

The northerly part of the watershed was included in the Huron tract developed by the Canada Company. The last area occupied was Mornington Township, surveyed in the 1840's and settled after 1850. This was at the time of Irish immigration to Ontario and many people of Irish origin settled in Mornington.

By 1880 all the land was opened up and the farm population well established. Also by that time the villages and towns, as they are now found, were well established.

FORESTRY

CHAPTER 1

THE FOREST

1. At the Time of Settlement

Good early descriptions of the original forest are rare but such accounts as do exist, along with the small patches of bush remaining today, provide the basis for forming a picture of what conditions were like when the pioneers first began to move into this part of the country.

The earliest description is probably that which appears in a report on the Huron Tract made by Dr. Wm. Dunlop[1], who was Warden of Woods and Forests for the Canada Company in 1821. The Huron Tract lay mostly west of the Nith Watershed but did include much of the present county of Perth, embodying the parts of North and South Easthope and Ellice Townships which lie within the watershed. The forests of Elma, Mornington and Wallace Townships were similar so that the report is applicable to this portion. "The summit level of the whole country is in the large swamp which, as will be seen by a glance at the maps, occupies so much of its centre. This swamp forms the reservoir of many of the branches of the large streams which water the great triangle of Upper Canada formed by the three lakes . . . and we have every reason to believe that it contributes greatly to the River Nith, which is a principal branch of the Grand.

"There are four distinct kinds of swampy land - the cedar swamp, the spruce swamp, the black ash swale and the mixed swamp. The tamarack grows in the very worst swamps; for where you see it, were you to drain the marsh, you would only convert it into a bed of sand. Cedar and swamp are so indissolubly assorted in the brain of a Canadian that when he finds cedar growth on dry land he immediately pronounces it to be a dry swamp".

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1. Report on Dominion Archives - Douglas Brymner 1898.

In describing the forest cover apart from the swamps he states that it is "mixed hardwood with sugar maple the principal growth, followed by beech, elm and basswood in various proportions. In some instances beech and elm predominate over maple but this is rare. Near the streams the hemlock and interspersed through the whole is the cherry, the butternut, the different species of oak and the birch. Pine is very rare".

Mr. W.H. Smith, writing in 1851[1] in describing the Township of Blenheim says, "The soil consists of sandy loam and clay; timber, beech, maple, oak, hickory, elm, basswood and white ash with white pine intermixed".

Of North and South Easthope Townships he says, "From the border of Wilmot to Stratford the Huron road divides the townships of North and South Easthope, the land generally is flat and low and a large portion of the timber is elm, usually an indication of wet land".

In the historical atlases of the Counties of Brant[2] and Oxford[3] are found the following references to the forest, "Burford township - the eastern part was originally oak openings or plains, the soil being capable of high cultivation and very productive.

"In its primitive state the towering pines of Blenheim had fellowship in those of Norwich and Dereham; while the maple leaf was seen in richest luxuriance in the Oxfords, Zorra and Nissouri".

The forests of Waterloo were described as follows: "Only one hundred and eighteen years ago this County[4]

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1. Canada, Past, Present and Future, W.H. Smith, 1851.
2. Illustrated Historical Atlas of the County of Brant, 1875.
3. Topographical and Historical Atlas of the County of Oxford, 1876.
4. Extracts from Introduction to "Waterloo County Forests and Primitive Economics" by E.W.B. Snider - Sixth Annual Report of the Waterloo Historical Society - Kitchener, Ontario, 1918.

was a dense wilderness of forest, covered with many varieties of hard and soft wood, such as maple, elm, oak, ash, cherry and the very best of white pine and some cedar and hemlock, besides other timber less numerous. The trees in these forests were as a rule of large size, from which the finest quality of timber and lumber could be produced. Some mammoth white pine trees are reported to have been cut. One at German Mills by actual measurement was a trifle over 170 feet high. Mr. George Israel of Kitchener reports two trees, each 7 feet in diameter by 170 or more feet high near Strassburg and Aberdeen. Mr. Jacob Stroh of Waterloo took measurements of a tree near Rosendale, two miles east of Bridgeport, which was 3½ feet in diameter by 185 feet high, and of which Mr. Stroh had a photo taken before it was cut down. Mr. John Killer, formerly of Waterloo and now residing in Kitchener, reports one tree 6½ feet in diameter by about 200 feet high which was cut in his father's bush in the year 1868 near or where now is Breithaupt Park. Mr. Killer transported the butt log of this tree, 12 feet long, to the Bridgeport sawmill, where with considerable extra labor, they succeeded in producing the choicest of white pine lumber with what was called a Muley saw, being an improvement on the primitive sash saw, and producing more and more accurate lumber. No definite information could be obtained as to the quantity of lumber in board measurement that this mammoth log produced. Mr. Noah Weber of Strassburg reports that he cut a pine log 20 feet in length, the diameter of which could not be obtained, but must have been about 4½ feet; it produced 1,600 feet of the finest lumber.

"Oak trees of great size were found in abundance along the streams in some of the bottom lands. Many trees could be found measuring from 3 to 5 feet in diameter. A partly decayed stump of a tree which was cut 50 or more years ago along the banks of the Conestogo River near St. Jacobs, appeared to be about 5½ feet in diameter. Mr. Stroh shows a splendid specimen of an oak tree in one of his photos which was

5 feet in diameter and 120 feet high. Where maple, beech and elm thrived best, appealed to the new settlers as indicating where the choicest soil for producing profitable crops would be found; and this kind of timber could be removed easiest and cleared at the least cost, the maple usually being the choice".

A more recent description of the forest near Galt was prepared by W. Herriot[1] in 1924. "There is a rapid change in the character of the flora between Galt and Paris as trees and plants that are fairly common a few miles below Galt disappear a few miles farther north. The chestnut and sassafras are both common below Galt but I have never seen either north of the city and throughout the chestnut country many plants grow that are confined to this area and never seen north of Galt, showing that marked climatic or geological changes must occur within comparatively few miles".

From the above descriptions and the farm woodlots of the present day we may deduce that the Nith River had its source in the level land of Mornington and Wellesley Townships which were largely covered by swamp forest consisting chiefly of white elm and silver maple trees. The remainder of the watershed was mainly covered with forest of the sugar maple-beech types with pine and hemlock scattered throughout. South of the City of Galt and extending through Paris and westward along the boundary of the watershed oak types with considerable stands of pine were present. The southern hardwood species were represented by chestnut and sassafras which reached the northern limit of their range here.

. <u>Since Settlement</u>

The attitude of the settlers to the forest was naturally antagonistic because the trees stood in the way of all their efforts at improvement and the great task of removing

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Trees of Waterloo County by W. Herriot, 12th Annual Report of the Waterloo Historical Society, 1924.

them by primitive means must be accomplished before any new development, whether it be constructing a road, clearing a farm or establishing a townsite, could be undertaken. This inimical view of the forest, along with the idea that the supply of timber was inexhaustible, was so firmly established that it is only in recent years that it has begun to disappear. Even today, woodland is still classified in the Census of Canada with wasteland and marshland, giving the impression that it is valueless instead of being listed with field crops, pasture and others which would imply that it is producing a crop of economic value.

Lumbering did not play the prominent part in the settlement of the Nith Watershed that it did on many watersheds in Southern Ontario, partly because there were no great quantities of pine and partly because of the distance from markets, though the records do show that a considerable amount of square timber was taken out and lumbering went along with and aided settlement to a certain extent.

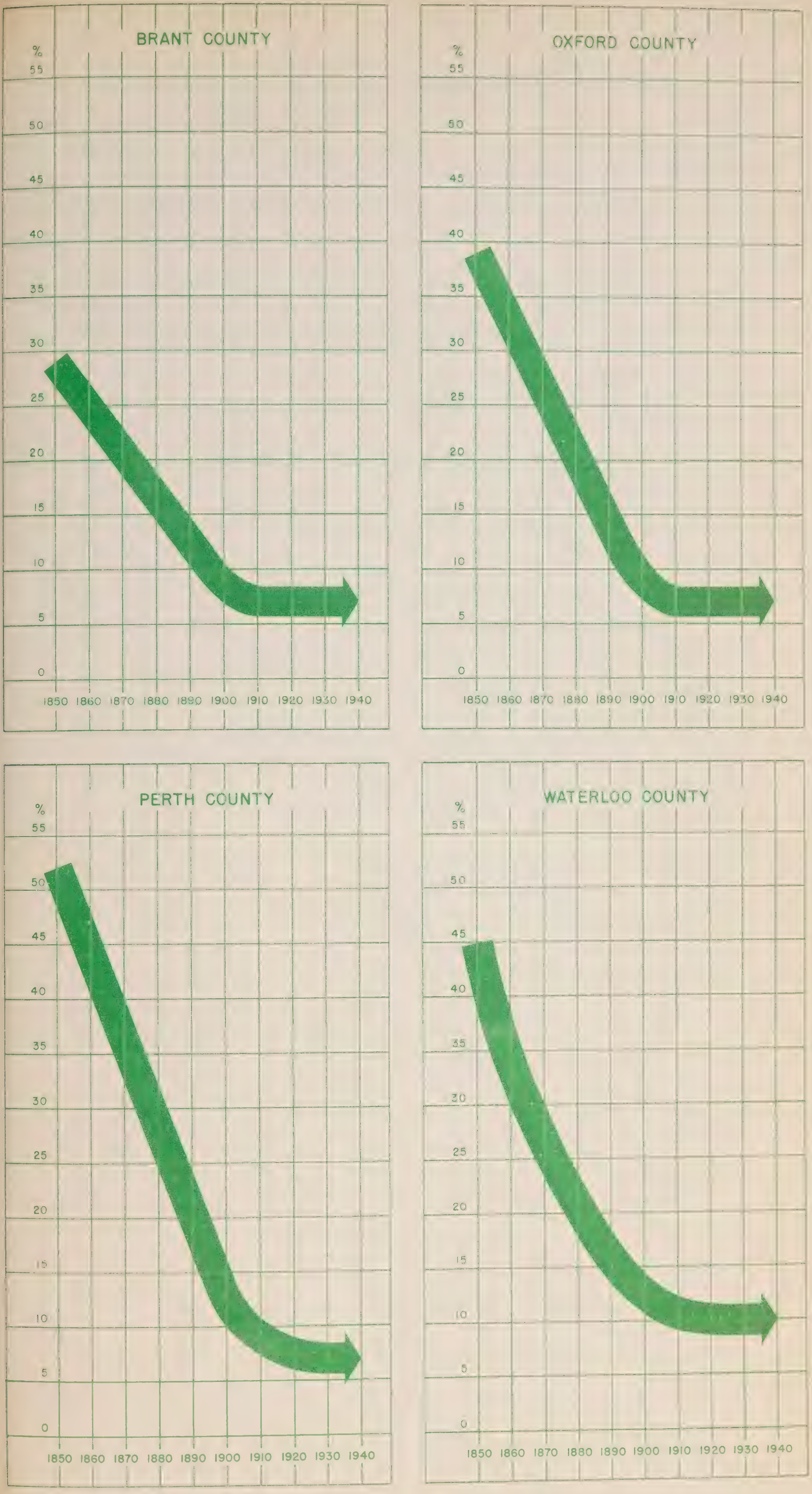
Most of the land is of high agricultural value and was largely covered with hardwood trees, for which there was a limited market. When a new area was opened for settlement the best land was taken first and the rough and swampy areas were avoided. Land was usually cleared first along the fronts of the farms. The land bordering the swamps was eventually settled, the swamps were partially drained so that the edges became dry enough for partial cultivation and the forest was pushed back so that today the centres of the swamps form the nuclei of the largest patches of woodland remaining in Southern Ontario; this is well exemplified by the Ellice Swamp which lies at the headwaters of Black Creek which is a tributary of the Nith flowing into Smith's Creek near Milverton.

Such swamps also form the largest natural surface water-storage areas and in many cases are the sources of the headwater streams. These areas are almost non-productive at the present time but there is no reason why they should not

CENSUS OF CANADA FIGURES

Township	Township Area	1850		1860		1890		1910		1920		1930		1940	
		Per Cent	Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Acres
Brantford	71,411	28	19,722	16	11,198	10	7,251	4	2,748	5	3,784	5	3,637	5	3,380
Burford	68,313	34	22,991	32	21,831	16	10,980	8	5,541	8	5,482	8	5,728	8	5,677
Dumfries S.	48,006	25	12,008	18	8,794	16	7,485	9	4,239	12	5,063	9	4,256	9	4,350
Totals	187,730	29	54,721	22	41,823	14	25,716	7	12,558	8	14,329	7	13,621	7	13,407
Blandford	29,769	43	12,814	33	9,874	15	4,456	6	1,850	8	2,397	8	2,238	9	2,666
Blenheim	66,944	37	24,876	29	19,163	14	9,507	7	4,406	8	5,152	8	5,160	8	5,566
Zorra E.	57,544	39	22,645	37	21,086	12	6,938	8	4,556	7	3,866	6	3,476	6	3,197
Totals	154,257	39	60,335	32	50,123	14	20,901	7	10,812	7	11,415	7	10,874	7	11,429
Easthope N.	43,123	47	20,200	36	15,390	10	4,456	12	5,352	12	5,008	12	5,152	12	5,176
Easthope S.	23,945	50	11,993	37	8,790	34	8,069	9	2,242	8	1,980	8	2,000	7	1,720
Ellice	54,933	21	11,355	24	13,419	16	9,010	4	2,250	6	3,342	4	2,268	4	2,318
Mornington	50,059	44	22,113	57	28,858	19	9,530	9	4,313	7	3,296	5	2,770	5	2,362
Wallace	50,423	100	50,423	65	32,264	25	12,742	8	4,210	9	4,456	8	4,269	7	3,754
Totals	222,483	52	116,084	44	98,721	20	43,807	8	18,367	8	18,082	7	16,459	7	15,330
Dumfries N.	44,951	31	14,170	30	13,423	14	6,311	12	5,319	11	4,949	10	4,586	11	4,990
Wellesley	65,066	59	38,379	40	26,067	19	12,207	11	6,982	10	6,768	10	6,326	9	5,643
Wilmot	61,520	39	24,144	31	18,940	14	8,409	10	6,173	10	6,357	10	6,208	10	5,877
Totals	171,537	45	76,693	34	58,430	16	26,927	11	18,474	11	18,074	10	17,120	10	16,510
Maryborough	56,300	32	17,932	53	29,696	21	11,719	9	4,792	8	4,748	9	5,236	7	3,923
Peel	74,445	47	34,812	48	35,881	16	11,642	7	5,266	7	5,473	6	4,738	6	4,405
Totals	130,745	40	52,744	50	65,577	18	23,361	8	10,058	8	10,221	8	9,974	6	8,328

No figures available for 1870, 1880 and 1900.



PER CENT WOODLAND

CENSUS OF CANADA FIGURES

be growing a crop of timber which is probably the most profitable crop which can be raised on them.

The comments of earlier writers with regard to land clearing and lumbering are of interest in tracing the gradual development of the country[1]:

> "Too frequently is it the case, that the person clearing land to make a farm, be he an old settler or a new arrival, commits indiscriminate slaughter among the trees, and makes a clean sweep . . . . destroying everything and leaving his dwelling unshaded and unsheltered for the next generation. Much of this absurdity, as far as the new settlers are concerned, must be attributed to the advice and assertions of the 'old inhabitants', who are in the habit of telling them 'Oh! it's of no use trying to save the trees, you can't do it, the wind will blow them all down'. Ask them if they have themselves tried the experiment and speak from experience, they will answer 'No' but they have been told so. We could show hundreds of instances of the folly of such declarations in trees which must have stood singly and alone for at least thirty or forty years, although at least two hundred or three hundred years old at the time they were singled out for their large size and left standing as landmarks. Yet they have not been overturned and are still strong and healthy, enjoying a green old age. The inhabitants of Waterloo have, in general, eschewed such notions and have in forming their farms and villages shown a little affection for the charms of nature. The township, the appearance of its hamlets and homesteads, its shady brooks and sheltered nooks are therefore the admiration of travellers.

> "After a clearing had been made enabling the production of more than for personal requirements the question of marketing the surplus was a serious one[2]. Nowhere nearer than Dundas was there a market of any consequence and even then the difficulty was to obtain cash for produce as in those days nearly all transactions were made in trade because cash was not easily procured and there was very little of it in the country. There were also many difficulties in transporting the produce to market. The so-called roads were merely trails cut through the woods and in the spring and fall were practically impassable, but when winter came on conditions for transportation became much better. Whenever swamps or low wet lands proved a hindrance the corduroy roads were brought into use. No drainage could be undertaken so logs were laid crosswise over the trails and covered with earth and this constituted the so-called corduroy road".

The rate of reduction of the forests was very rapid as is shown by the accompanying tables and graphs; for

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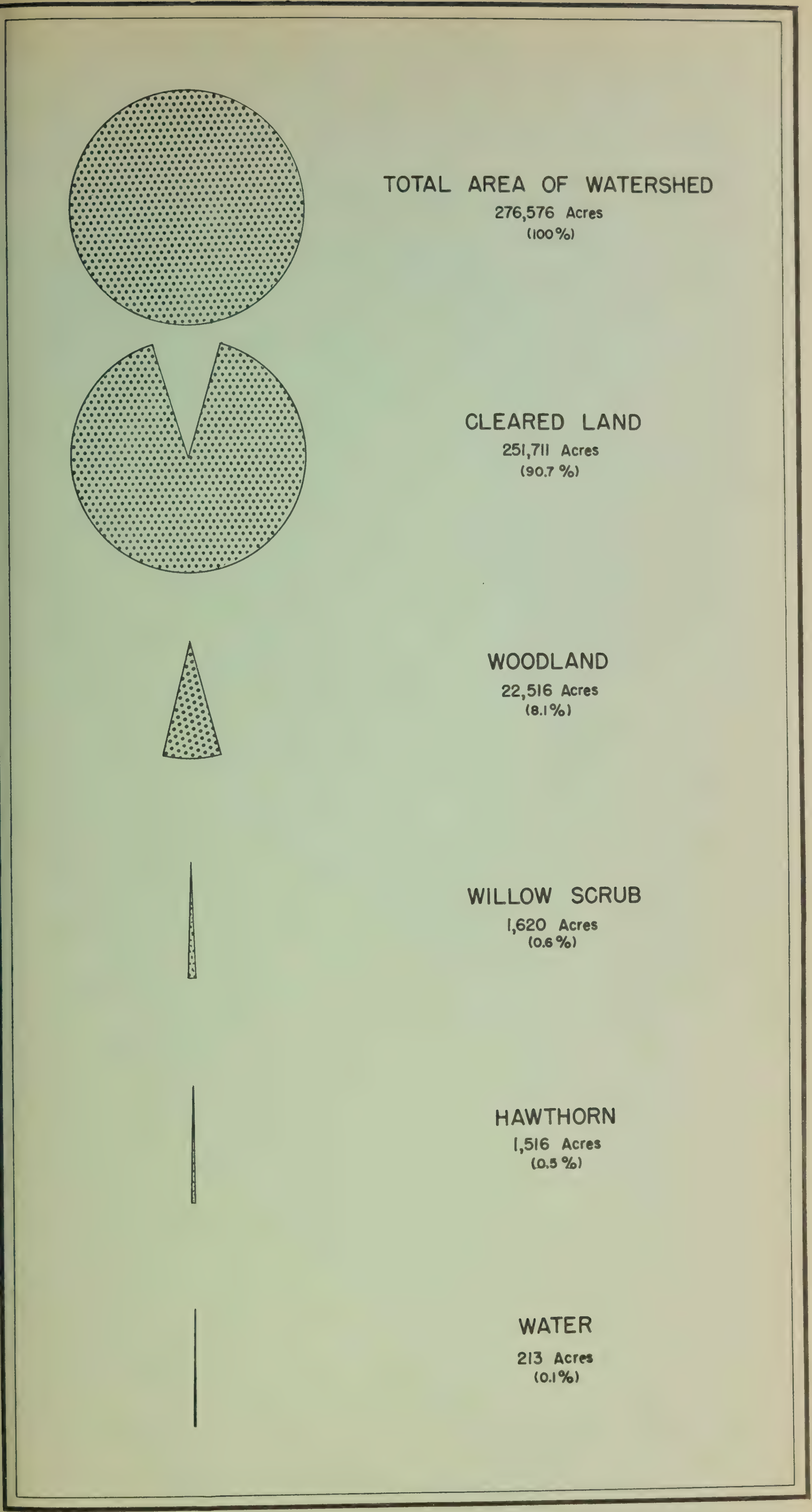
1. Canada, Past, Present and Future - W.H. Smith, 1851.
2. Waterloo County Forests and Primitive Economics - E.W.B. Snider, 6th Annual Report Waterloo Historical Society, 1918.

example, in Wellesley Township the area of woodland on occupied farms dropped from 59 per cent in 1850 to 19 per cent in 1890 and 10 per cent in 1910. According to the Census of Canada figures the other townships show a similar drop. The chief value of these figures lies in showing the rate at which the bush was cleared rather than the actual acreages of woods remaining at the given dates because the definition of woodland varied from person to person. For example, one farmer or census taker might consider a certain cutover area to be pasture while another would call it woodland, because considerable reproduction or young growth still remained, and this caused many discrepancies in the figures.

The actual measurement of the woodland area within the watershed made in 1949 shows a total of 22,516 acres or 8 per cent of the total area.



LAND CLASSIFICATION – TOTAL WATERSHED

CHAPTER 2

FOREST PRODUCTS

1. Early Policy

Previous to 1826 the only persons authorized to cut timber on the public lands were the contractors for the Royal Navy, or those holding licenses from them, and there was great infringement of the regulations and much illicit trade, but in this year the first steps toward making the forest resources a source of revenue to the Province and "so securing to the public a share of the wealth drawn from the public domain" led to co-operation among the officials and the termination of the contractor's monopoly. The inauguration of a system under which anyone was at liberty to cut timber on the ungranted lands of the Ottawa lumber region on payment of a fixed scale of rates to the Crown, overcame in large part the annoyance of the people and authorities in the colony against the export of the sound Canadian timber for the British Navy.

2. Masting

The selection of mast timber was made by government agents who went through the forest blazing with a broad arrow - the mark of the British Government. As late as 1827, when Peter Robinson was appointed Surveyor-General of His Majesty's woods and forests in the Province of Upper Canada, he was instructed "to make a survey of the districts where there may be any considerable growth of masting and other timber fit for the use of His Majesty's Navy".

The mast and spar export to Britain was thriving in the thirties and forties and it was continued intermittently as late as 1855. The British trade dropped off noticeably after 1854 and this may be attributed to the Reciprocity Treaty with the United States in that year, "securing the free exchange of the natural products between Canada and the United States, including timber and lumber of all kinds, round, hewed, and sawed, manufactured in whole or in part", and the building

of railway connections with the United States border cities.

3. Squared Timber

The squared timber trade commenced, no doubt, somewhat later than the mast trade and was carried on simultaneously with it from the thirties.

Squared timber consisted of selecting large trees, mostly white pine, and squaring the best part into one long stick. In the earliest days of the industry the timbers were squared on all four sides to a fine "proud edge", but later when the best timber had been cut they were squared with a rounded shoulder or "wane", and were known as "waney timber". Such methods, of course, were wasteful since the finest grained wood was sacrificed in the operation, but this was the type of material called for by the British market.

"Often only one tree in a thousand would yield a finished 'stick' (so was the heavy squared timber nonchalantly called in the trade) fit for export. A good stand might yield thirty or forty trees an acre for over the whole area allowances had to be made for 'wants' -- the non-bearing patches of swamp, burn, etc. Today a whole township or limit (in Northern Ontario) may not have one good square stick of the quality of the square timber of another day[1]".

The timbers were transported by the river, by teams or by railway to the lake and were built into huge rafts, on which the lumberjacks built shanties and lived during the trip down to the timber coves at Quebec.

4. Saw Material

From 1800 on the cutting of timber had been one of the most important domestic businesses in most parts of Southern Ontario, and a very considerable business was carried on.

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1. One Hundred Years A'Fellin', 1842 - 1942, Gillies Bros., Limited.

In order to convert logs into boards the first method used was pit-sawing. This was sometimes done on the bank of the river, as such procedure saved the necessity of digging a pit.

The more usual methods of pit-sawing appear to have been the digging of a pit or building of a platform with a simple but firm and strongly constructed framework. In either case the framework was made the right height for one man to stand underneath, while the other man stood above on the platform or astride the log. This hard method of sawing timber was labourious, and 25 boards were a heavy day's work for two men; the boards being nearly always one inch thick, with planks two inches, and the occasional flooring of one and a half inches in thickness.

The first power saws were a direct development of the manually operated pit saw. These were called frame, upright or muley saws and consisted of a saw set vertically in a wooden frame and moved up and down by means of a crank connected to the shaft of the water wheel.

> "Wherever a settlement is formed in America a sawmill is very soon after, if not at the same time, erected. The number of sawmills in the British colonies are inconceivable to those who are not familiarized to the rising settlements of new countries.
>
> "A sawmill is in fact a most important establishment. It not only forms a nucleus or centre to a settlement, but a first-rate sawmill, with two frames, will give employment to four first-rate, four second-rate and two third-rate sawyers, besides a measurer, a blacksmith and from thirty to forty men to prepare the timber required and for other requisite work connected with the establishment; twenty oxen and two horses are also necessary for hauling the timber required to streams and to other places. The boards, deals and scantlings sawed at these mills, excepting such as are required for the use of the neighbouring settlers, are rafted down the river for shipping. As fresh waters change the colour of the deals from their fresh whiteness to a dark gray and, in the eyes of prejudice, depreciate their value, it becomes an object but one that can only be attended to occasionally to carry them down in bateaux, scows or on timber rafts[1]".

A study of the Census of Canada returns of

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1. British America, Vol. II - John McGregor, 1833.

FOREST PRODUCTS OF FARMS

CENSUS OF CANADA FIGURES

BRANT COUNTY

PRODUCTS	SPECIES	UNIT	1870	1880	1910	1920	1930	1940
.PWOOD		CORDS	*		0	9	0	0
BARK		CORDS	25	68	30			
HWOOD		CORDS	100	110				
TS & SPARS		NUMBER	0	37	0			
VES		THOUSANDS	400	206	(2)			
CE RAILS		NUMBER				5,778	1,835	
CE POSTS		NUMBER			18,813	28,431	16,589	
ES		NUMBER			2,221	0	165	
LWAY TIES		NUMBER			3,650	0	0	
ARE TIMBER	BIRCH	CU. FT.	0	404(1)				
	ELM	CU. FT.	0	8,922				
	OAK	CU. FT.	63,429	62,684				
	WHITE PINE	CU. FT.	2,219	30,204				
	RED PINE	CU. FT.	1,426	2,625				
	TAMARACK	CU. FT.	2,430	8,451				
	OTHERS	CU. FT.	2,596	73,812				
	TOTAL	CU. FT.	72,100	187,102				
S	PINE	NUMBER	60,639	103,387		{10,675		
	OTHERS	NUMBER	11,194	49,597				
S	PINE	CU. FT.			353M			
	HEMLOCK	CU. FT.			127M			
	SPRUCE	CU. FT.			40M			
	OAK	CU. FT.			185M			
	ELM	CU. FT.			599M			
	WALNUT	CU. FT.	0	400				
	HICKORY	CU. FT.	110	2,108	7M			
	BUTTERNUT	CU. FT.	0	0				
	OTHERS	CU. FT.			603M			
	TOTAL	CU. FT.	110	2,508	1,914M			
LWOOD	CORDS		56,924	68,139	29,174	35,757	24,900	14,186
ERS	VALUE $				513	0	198	9,749(3)

FOREST PRODUCTS OF FARMS

CENSUS OF CANADA FIGURES

WATERLOO COUNTY

PRODUCTS	SPECIES	UNIT	1870	1880	1910	1920	1930	1940
.PWOOD		CORDS	*		10	0	12	0
BARK		CORDS	353	237	7			
HWOOD		CORDS	0	1,447				
TS & SPARS		NUMBER	93	0	0			
VES		THOUSANDS	825	327	(2)			
CE RAILS		NUMBER				6,540	5,670	
CE POSTS		NUMBER			11,314	15,264	16,371	
ES		NUMBER			399	181	902	
LWAY TIES		NUMBER			112	0	0	
ARE TIMBER	BIRCH	CU. FT.	2,407(1)	33,006(1)				
	ELM	CU. FT.	13,539	38,463				
	OAK	CU. FT.	1,022	35,103				
	WHITE PINE	CU. FT.	11,213	45,394				
	RED PINE	CU. FT.	1,509	3,367				
	TAMARACK	CU. FT.	3,266	7,860				
	OTHERS	CU. FT.	122,185	143,932				
	TOTAL	CU. FT.	155,141	307,125				
S	PINE	NUMBER	30,920	94,948		{18,862		
	OTHERS	NUMBER	8,842	112,926				
S	PINE	CU. FT.			447M			
	HEMLOCK	CU. FT.			86M			
	SPRUCE	CU. FT.			2M			
	OAK	CU. FT.			84M			
	ELM	CU. FT.			1,453M			
	WALNUT	CU. FT.	0	0				
	HICKORY	CU. FT.	0	200				
	BUTTERNUT	CU. FT.	0	1,200				
	OTHERS	CU. FT.			1,416M			
	TOTAL	CU. FT.	0	1,400	3,488M		883M	
LWOOD		CORDS	82,051	92,648	27,340	25,190	24,095	20,240
ERS		VALUE $			136	585	100	25,485(3)

* In all blank spaces the item is not listed in that census.
(1) Includes Maple.
(2) Included in "Others - Value $" below.
(3) Includes fence posts, rails, railway ties, logs for lumber, pit props, etc.
M = M bd. ft.

FOREST PRODUCTS OF FARMS

CENSUS OF CANADA FIGURES

OXFORD COUNTY

PRODUCTS	SPECIES	UNIT	1870	1880	1910	1920	1930	1940
ULPWOOD		CORDS	★		0	0	0	0
ANBARK		CORDS	586	444				
ATHWOOD		CORDS	193	37				
ASTS & SPARS		NUMBER	0	226	9			
TAVES		THOUSANDS	634	1,704	(2)			
ENCE RAILS		NUMBER				3,657	1,920	
ENCE POSTS		NUMBER			10,542	12,815	14,749	
OLES		NUMBER			195	15	516	
AILWAY TIES		NUMBER			15	0	0	
QUARE TIMBER	BIRCH	CU. FT.	3,545(1)	29,663(1)				
	ELM	CU. FT.	166,196	78,025				
	OAK	CU. FT.	41,950	59,921				
	WHITE PINE	CU. FT.	13,264	12,791				
	RED PINE	CU. FT.	614	1,418				
	TAMARACK	CU. FT.	52,525	38,291				
	OTHERS	CU. FT.	94,557	116,168				
	TOTAL	CU. FT.	372,651	336,277				
OGS	PINE	NUMBER	35,788	105,020		{17,770		
	OTHERS	NUMBER	13,157	164,538				
OGS	PINE	CU. FT.			178M			
	HEMLOCK	CU. FT.			26M			
	OAK	CU. FT.			51M			
	ELM	CU. FT.			1,397M			
	WALNUT	CU. FT.	300					
	HICKORY	CU. FT.	7,830	5,472				
	BUTTERNUT	CU. FT.	1,436	1,000				
	OTHERS	CU. FT.			1,184M			
	TOTAL	CU. FT.	9,566	6,472	2,836M			
UELWOOD		CORDS	142,282	165,199	61,311	73,186	49,203	38,973(3)
THERS		VALUE $			124	100	731	14,315(3)

FOREST PRODUCTS OF FARMS

CENSUS OF CANADA FIGURES

PERTH COUNTY

PRODUCTS	SPECIES	UNIT	1870	1880	1910	1920	1930	1940
ULPWOOD		CORDS	★		0	0	0	10
ANBARK		CORDS	2,556	2,533	11			
ATHWOOD		CORDS	184	108				
ASTS & SPARS		NUMBER	30	507	0			
TAVES		THOUSANDS	405	1,921	(2)			
ENCE RAILS		NUMBER				10,223	29,769	
ENCE POSTS		NUMBER			580	5,815	5,149	
OLES		NUMBER			7,048	5	49	
AILWAY TIES		NUMBER			0	0	100	
QUARE TIMBER	BIRCH	CU. FT.	5,806(1)	7,611(1)				
	ELM	CU. FT.	103,902	174,632				
	OAK	CU. FT.	8,933	55,243				
	WHITE PINE	CU. FT.	14,723	30,636				
	RED PINE	CU. FT.	1,518	17,051				
	TAMARACK	CU. FT.	7,388	6,530				
	OTHERS	CU. FT.	170,342	330,998				
	TOTAL	CU. FT.	312,612	622,701				
OGS	PINE	NUMBER	61,130	154,017		{17,147		
	OTHERS	NUMBER	35,187	198,427				
OGS	PINE	CU. FT.			0			
	HEMLOCK	CU. FT.			32M			
	SPRUCE	CU. FT.			3M			
	OAK	CU. FT.			75M			
	ELM	CU. FT.			1,647M			
	WALNUT	CU. FT.	160	525				
	HICKORY	CU. FT.	530	100	1M			
	BUTTERNUT	CU. FT.	0	131				
	OTHERS	CU. FT.			284M			
	TOTAL	CU. FT.	690	756	2,042M		462M	
UELWOOD		CORDS	115,030	134,429	44,470	56,244	35,952	27,127(3)
THERS		VALUE $			74	772	740	10,590(3)

★ In all blank spaces the item is not listed in that census.
(1) Includes Maple.
(2) Included in "Others - Value $" below.
(3) Includes fence posts, rails, railway ties, logs for lumber, pit props, etc.
M = M bd. ft.

forest products of farms for the counties of the watershed given in the table reveals the various trends and changes in the lumber industry fairly clearly.

From 1870 to 1890 much of the timber was squared and measured in cubic feet. In 1870 other products listed were firewood, staves, lathwood, tanbark, and masts and spars. In 1880 the peak production of nearly all items was reached and squared elm alone in Perth County ran to almost 174,000 cubic feet in 1880. In 1890 fence posts and telephone poles were added to the list of products as were railway ties. In the census years of 1900 and 1910 squared timber was still recorded in cubic feet and logs were measured in board feet; staves, lathwood, masts and spars and tanbark disappeared from production.

In 1920 no squared timber is shown, logs are only counted, not measured and not even separated by species. The returns of the latest census covering the year 1940 name only one forest product and the rest are all listed together as others valued at so many dollars. The one product which has persisted throughout the records is firewood which in Oxford County has dropped from a peak of 165,199 cords in 1880 to 38,973 cords in 1940.

One or two interesting observations with regard to individual species may also be made. Tamarack was listed regularly until 1890 after which it no longer appears due to the depredations of the larch saw-fly which almost wiped it out at this time. The returns show that some black walnut and hickory were cut in all counties each year until 1880. White pine was, of course, the species most sought after though not much existed in the counties of the watershed, and next to it red pine, of which a little was present in all counties. In 1870 and 1880, elm and oak were the main species which were squared, but as these species became scarce more ash, birch and maple were made into square timber.

5. Shingle Making

In the history of roofing used on the Nith Watershed it is found that the first covering for human habitation on the river was the Indian elm-bark lashed roof. The first type of roof used by the early settlers was made of "scoops" which were flattened logs, usually cedar, six inches thick with one face scooped out to a depth of 1 to 1½ inches. These ran from the peak of the roof to the eaves, being placed alternately so that one scoop had the scoop side up and the next one the scoop side down, the edges overlapping the two scoops below.

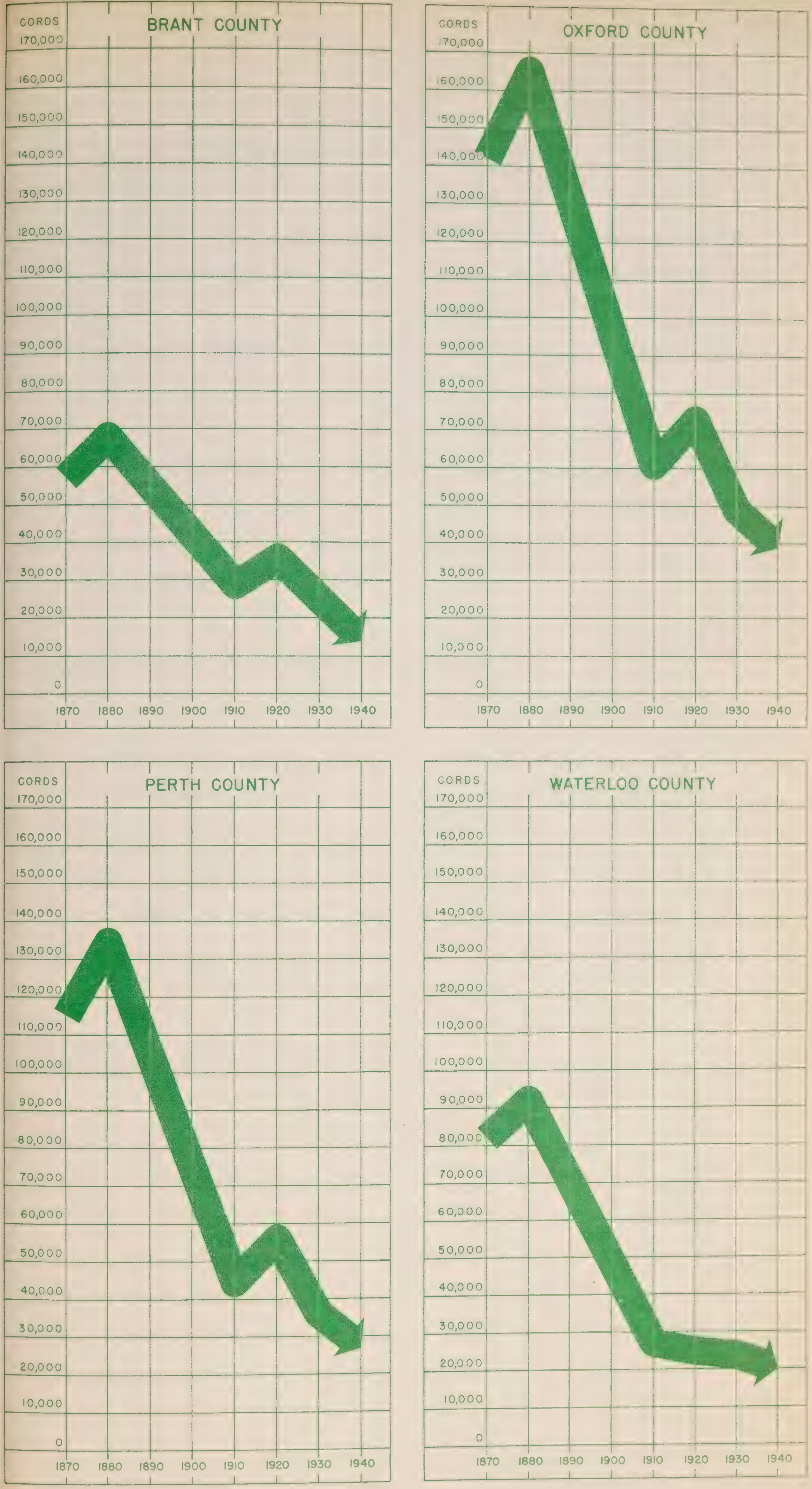
The second type of covering was a rude type of shingle called a "shake". These were made with an axe or frow and were cut from pine or cedar three or more feet in length. Although not shaped they were a great improvement over the early types of covering.

Very early in the history of settlement, however, hand-made shingles were introduced. The shingle maker would saw the logs into short lengths or bolts and split them with a frow to the right thickness. The shingle was then fastened by one end in a device called a shingle horse and by means of a heavy drawknife the shingle was tapered to an edge. This method was rapid and it has been said that a good shingle maker would turn out from 80 to 100 of these hand-made shingles an hour.

Up to the seventies and even later the shingle maker continued to use drawknife and frow, but gradually in the seventies the generation of craftsmen died out and the shingle mill, where shingles were sawn, became the general source of supply.

6. Fuel and Ties

From the earliest days of settlement on the Nith to 1850 wood was the sole source of fuel supply. All species were used for this purpose including beech and maple - although



FUELWOOD PRODUCTION

CENSUS OF CANADA FIGURES

these were furniture woods as well. With the inception of the railway and steam-driven factories the forests of the area were ruthlessly cut to feed industry.

In the very early days of the steamship, 1832, the Honourable Adam Fergusson writes: "Wood is furnished upon the St. Lawrence for one dollar, or five shillings per cord, while upon the Hudson it now costs three times as much. A man may prepare two cords a day but it is severe work, and the price, which is one dollar per cord, will do little more than compensate maintenance and labour - and an ordinary steamboat consumes fifty or sixty cords or about 7,000 cubic feet each trip (from Montreal to Quebec)". The price of cordwood in 1825 was quoted at $2.00 a cord.

With the completion of the Grand Trunk between Toronto and Stratford locomotive requirements took large quantities of the best body hardwood, chiefly beech and maple. After the railways came there was a market open for cordwood which was used as fuel for railway locomotives. "Coal at that time was not to be had and the result was that hardwood was gradually becoming of some value. For number one cordwood the settlers usually realized from $2.50 to $3.00 per cord, delivered at the various stations along the railway line. Railway facilities also stimulated the lumber industry[1]".

7. Road Materials and Fencing

In the early days the making of corduroy roads furnished another important wood use. The Indian trails had followed the ridges and natural conformation of the country, but when the "T-square" roads had been laid out in government offices they followed the arbitrary lot and concession lines regardless of natural contours. Many of these roads were built through swamps and in these places corduroy construction was used. Many corduroy bridges and culverts were also placed over

[1] Waterloo County Forests and Primitive Economics, E.W.B. Snider. 6th Annual Report of the Waterloo Historical Society, 1918.

the river and its tributary streams.

The building of plank roads - a form of highway in which the planks were laid crosswise and side by side - was done in several parts of the Province, but there is no evidence that any roads in the Nith Watershed were planked, though the road to the south through Bishopsgate and Burford was planked. The reasons for the lack of planked roads were probably the comparative scarcity of pine and the fair supplies of gravel in the Nith drainage area.

Much wood was also used for fencing and for this cedar from the swamps was most common. The troublesome pine stump also was used for this purpose in many parts of the Province, although in very early times it seems that it was left in the fields. Around 1900 the wire fence came into use generally and thereafter a fence post industry was developed. These were cut as a rule to a standard length of eight feet, while the diameter varied greatly.

8. Woodworking and Planing Mills

During the early years of settlement in the rural districts and communities house trim for exterior and interior was made by the same man who constructed the frame of the house. The custom up to the fifties at least was for the carpenter to board with the family the winter before the new frame house was to be built and work all his timber into shape by hand, both for the exterior and interior use.

The early carpenter also made door and window frames and all interior trim of the house by hand and, for all these products, pine was the usual type of timber chosen. It would seem that doorsteps were one of the very few things for which oak was used in house building, at least up to the sixties. For example, an old-timer is reported to have said when asked if they used much oak in the early days, "No, we didn't need to. We had plenty of pine".

Generally, as time passed, the building trades

became more differentiated and more craftsmen settled on the watershed.

After the appearance of the planing mill in the fifties the end of the hand-made door and window frames was foreshadowed and much of the general carpenter's work was taken over by mill or factory. For example, in the 1860's the planing mill business was well under way.

9. Wooden Implements and Vehicles

(a) Early Tools

From the very early days hickory was preferred for the making of axe-helves or handles, while for beams or ox-yokes beech was used extensively, and for the loop ironwood would probably have been selected. Spike handles were made of rock elm, white ash, hickory or ironwood; the beetle-head (a mallet used for pounding hemp and flax) was also made of ash, elm, hickory or ironwood. The hardwoods growing on the watershed were used almost entirely for making handles of implements, whereas pine was preferred for all building operations.

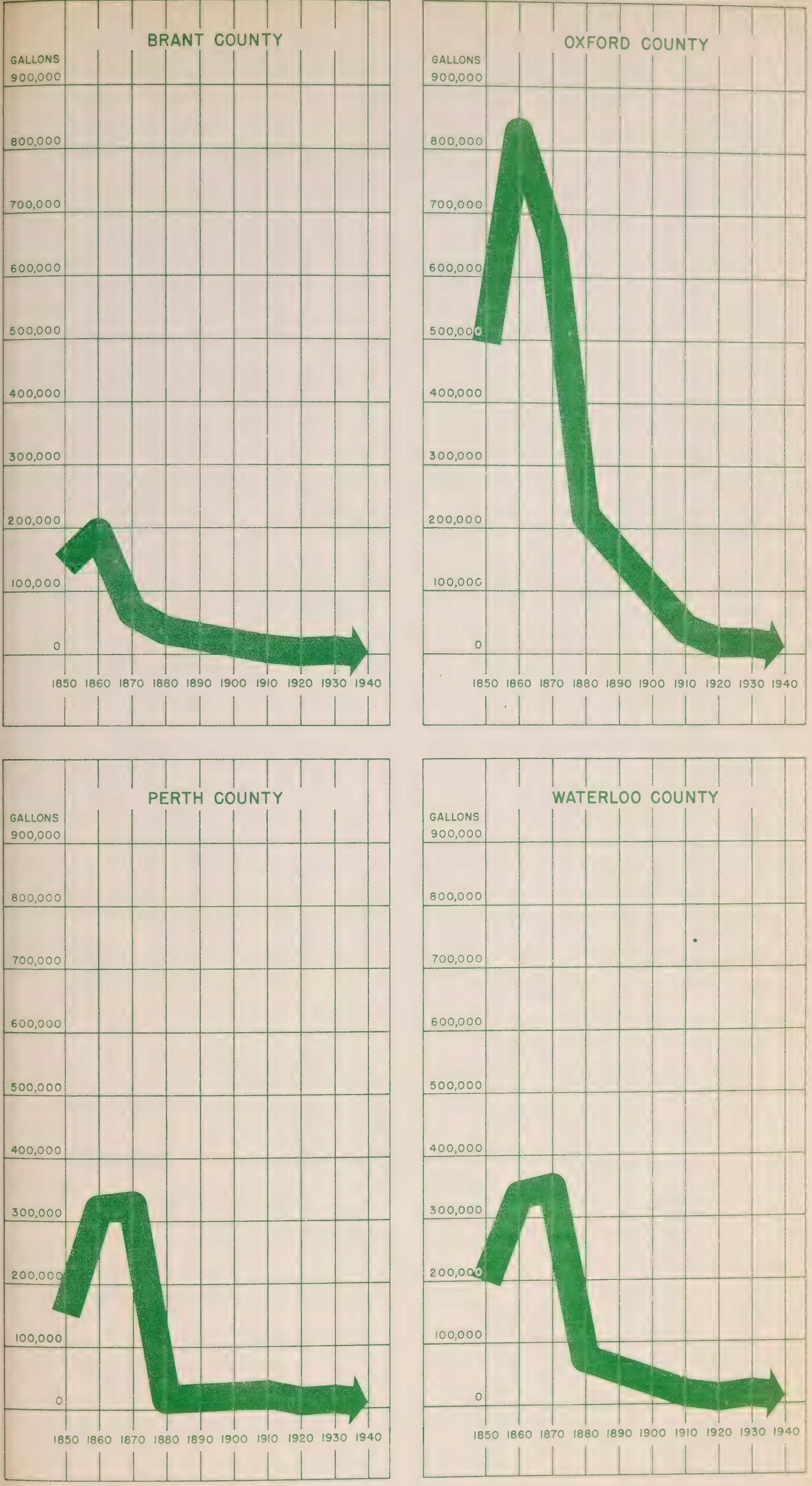
As settlement developed and more craftsmen arrived in the area the general types of agricultural implements improved and metal replaced wood in large part.

(b) Vehicles

From early times the making of vehicles progressed as carts, wagons, sleighs and hay and wood racks were built by the farmers. In the building of carts and wagons, whiffletrees, wagon-tongues and binding poles were made of rock elm, white ash, hickory and ironwood, as were also sleigh-runners and hay and wood racks. Usually the wheels or runners of these conveyances were bound with iron, although the use of metal was limited in early days since the supply had to be imported by water.

10. Indirect Products and By-Products

The three indirect products of greatest importance were potash, maple sugar and tanbark. Maple sugar fur-



MAPLE SYRUP PRODUCTION

CENSUS OF CANADA FIGURES

CENSUS OF CANADA FIGURES

County	1850	1860	1870	1880	1910		1920		1930		1940	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.
Brant	91,995	124,632	43,323	24,165	1,794	5,867	210	2,903	390	4,350	40	2,085
Oxford	320,952	538,373	425,105	142,880	2,580	35,100	50	17,926	215	16,689	194	9,705
Perth	99,125	207,286	210,224	9,037	803	21,269	209	9,503	140	13,627	810	6,343
Waterloo	129,160	218,077	226,329	47,414	1,373	13,537	20	8,816	1,001	12,892	642	9,161
Wellington	146,220	317,215			1,288	11,587	13	7,553	194	12,332	1,243	5,979

	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.
Brant	141,611	191,933	66,717	37,214	8,630	3,226	4,951	2,145
Oxford	494,266	829,094	654,662	220,035	39,073	18,003	17,020	10,004
Perth	152,653	317,148	323,745	13,917	22,506	9,825	13,843	7,590
Waterloo	198,906	335,731	348,547	73,018	15,651	8,847	14,434	10,148
Wellington	225,179	488,511			13,571	7,573	12,631	7,893

Figures for 1890 and 1900 not available.
In the second table, pounds of sugar have been converted to their equivalents in gallons for purposes of comparison.

nished the staple sugar for the pioneers, cane sugar not, at that time, having been procurable; lye or potash was used domestically in making soft soap - almost the universal soap; tanbark was utilized in dressing leather by the shoemakers.

(a) Potash

The ashery played an important role in the drama of pioneering life and, besides communal asheries, the individual ash house and the ash barrel on a platform for leaching was a characteristic of each farm in the days before the soap manufactory came into being. "Only from the sale of potash (exported to Great Britain and the United States for the dyeing of textiles) was there money for all other requisites. The potash was labouriously produced, men, women and children sharing in the heavy work. No less than 60 large maple trees were required for a barrel of 650 to 700 pounds of potash. The ashes of the burnt wood were leached in wedge-shaped wooden troughs and this liquid was then boiled down and cooled in huge vessels or coolers where the lye solidified. Two coolers would fill a barrel. If the settler marketed this on his own, 'toting it out' to the nearest buyer for ready cash, he might get only $8.50 to $9 but if he could wait and accept a down payment from the traders and shippers who teamed and hauled at a season of their own convenience, he might get $10 or $12 with a possible second payment after marketing it at Montreal where a barrel might bring $30 less, of course, commission, risk and portage costs. The need for this pitifully hard-won money led to clearing of more land than could be cropped and not infrequently to concealing for years the fact that the holding itself might not be profitable or capable of sustaining the settlers from the growth of its poor soil [1]".

(b) Maple Sugar

The table shows the Census of Canada figures for

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1. One Hundred Years A'Fellin', 1842-1942 - Gillies Bros. Ltd.

maple products in the counties of the watershed. It is interesting to note that up to 1910 production is all recorded as pounds of sugar, from 1910 on both pounds of sugar and gallons of syrup were shown, indicating the change from a pioneer necessity to the modern luxury. For purposes of comparison the sugar figures have been converted to their syrup equivalents and from these shown in the second half of the table it will be seen that production in Oxford County dropped steadily from the peak of over 800,000 gallons in 1860 to 10,000 in 1940.

CHAPTER 3

PRESENT WOODLAND CONDITIONS

Physiographically the Nith Watershed may be considered in three parts: the till plain, the morainic areas and the meltwater channels running through the moraines. Each of these has had its effect on the forest cover. The till plain covers the northern third of the watershed, including portions of Wallace, Maryborough, Elma, Mornington, Ellice and the west half of Wellesley Townships. The Milverton moraine forms a long narrow strip running north and south through Milverton in Mornington Township and the remainder of the watershed including the eastern half of Wellesley Township is also moraine country. The extreme southern and south-eastern fringe of the watershed, south of Highway No. 2 and along Highway No. 24 between Paris and Galt, lies within the area known as the Deciduous Forest Region[1]. The whole of the remainder of the watershed lies in the Huron-Ontario Section of the Great Lakes-St. Lawrence Forest Region. The Deciduous Forest reaches its northern limit here and is composed largely of broad-leaved trees, including shagbark, bitternut and pignut hickory, sassafras, walnut and red cedar. White pine occurs on the drier sites and hemlock is present on the lighter soils. The Huron-Ontario Section which comprises the remainder of the watershed is characterized by a forest in which sugar maple and beech are the dominant species. With them are basswood, white elm, white ash, some yellow birch and red maple and red, white and bur oak. Small groups of hemlock and white pine occur within the association, as well as a scattered distribution of large-toothed aspen, bitternut hickory, butternut, ironwood and black cherry; blue beech, slippery and rock elm and black ash are found locally on specialized sites such as bottom lands and swamps. White pine occurs mostly on the lighter soils of the

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1. Forest Classification for Canada - W.E.D. Halliday, 1937.

moraine, as does trembling aspen and large-toothed poplar where the pine stands have been cut and burned over in the past.

1. Survey Methods

Each member of the forestry party was provided with aerial photographs which were on a scale of 1,000 feet to the inch and each photograph covered an area of approximately 1,000 acres, usually a block lying between two adjacent concession roads and two adjacent side roads, and mapping was done in the field directly on the photographs.

Every area of woodland, brushland, marsh, swamp and rough land was visited and notes made describing it. In the case of woodlots and plantations, detailed notes were made of their condition. Overgrazed woodlots and woodlots with very scattered trees which could be restored were classified as woodland. In short, where doubt existed as to whether an area should be classified as woodland or not, woodland was given the benefit of the doubt.

All woodlots were grouped according to the following classification:

Diameter Breast High	Hardwood	Mixed Wood	Coniferous
Virgin	H-1	M-1	C-1
Over 18 Inches	H-2	M-2	C-2
10 Inches to 18 Inches	H-3	M-3	C-3
4 Inches to 10 Inches	H-4	M-4	C-4
Under 4 Inches	H-5	M-5	C-5

In this classification the term "hardwood" is used to denote all broad-leaved trees irrespective of whether the wood is physically hard or not. A hardwood type is one in which 80 per cent or more of the stand is composed of hardwood trees, a coniferous type is one in which 80 per cent of the stand is composed of coniferous trees and a mixed stand embraces all others.

FOREST COVER TYPES

NO. OF WOODLOTS	NO. OF ACRES	4	4A	6	9	10	11	12	13	14	14A	15	22	24
2	22													
69	742	154					15			111			26	
5	53	2					2			9				
8	36						5			13				
189	1,323	70					11	3	36	116			36	7
299	2,813	56				5	78	8	107	285			8	231
23	629	521								14				
267	2,703	67					67		32	302	5			291
3	19													
3	14									12				
583	5,732	75			16		101		179	1,478				861
47	298	5					23		1	31	2			
8	49	1								15				
575	4,508	406		3	12	5	19		78	363	6	12		748
227	1,905	84	8	2	123	1	11		123	231	34	13		401
185	1,284	58			8				67	110				43
44	283				6		2		5					53
10	103								2					5
2,547	22,516	1,499	8	5	165	11	334	11	630	3,090	47	25	70	2,640
	100.00	5.84	.03	.02	.64	.04	1.30	.04	2.45	12.04	.18	.10	.27	10.29

NO. OF WOODLOTS	NO. OF ACRES	25	26	45	47	49	50	51	52	57	58	59	60	60A	88
2	22									20				2	
69	742		80							38		21	119	178	
5	53												40		
8	36									10		2		6	
189	1,323		224							252		24	286	255	3
299	2,813	5	93							835	1	58	704	338	1
23	629									11		25	44	14	
267	2,703		47							1,280	11	21	366	212	2
3	19									6			13		
3	14													2	
583	5,732	17	49	8			11		1	2,128	32	59	284	415	18
47	298							10	1	202			19	3	1
8	49									3		18	4	8	
575	4,508	14	879			44	46	11		721	11	51	756	311	12
227	1,905		228		1	114	31	12	17	276	2	6	72	96	19
185	1,284		28			131	6	24	8	118	12	258	240	163	10
44	283	7	44					2		8		5	132	6	13
10	103							13					32	51	
2,547	22,516	43	1,672	8	1	289	94	72	27	5,908	69	548	3,111	2,060	79
	100.00	.17	6.51	.03	.00	1.12	.36	.28	.11	23.10	.26	2.13	12.12	8.03	.31

Stands were also grouped according to forest cover types. See table, the description of forest types and map folded at the end of this report.

Where plantations were encountered records were made of planting, care, damage and survival.

2. Forest Cover Types

In making the survey of the woodlots no attempt has been made to classify them according to forest types. Forest cover types only have been used and a forest cover type is defined as being[1] "a forest type now occupying the ground - no implication being conveyed as to whether it is temporary or permanent".

A forest cover type may be either temporary or permanent; for example, the present stand may be aspen which has seeded in the area following fire. Aspen seed is light like dandelion seed and is carried easily by the wind, thus it quickly covers large areas. Also it is not exacting in its soil requirements and may be the only species which will grow under the soil conditions existing at the time. The fact of its growing and dropping its leaves on the ground gradually improves the condition of the soil so that more exacting specie can grow. In addition its light shade frequently provides the correct light conditions for better species to get a start. As it is a short-lived tree it will die early and the other specie will dominate the area. This succession may be carried through two or more stages until the species best suited to the area or best able to maintain itself on the area takes over. This is called the forest type or climax type as distinguished from the forest cover type which is the type occupying the ground at the present time. The most common forest type on the Nith Watershed is sugar maple-beech.

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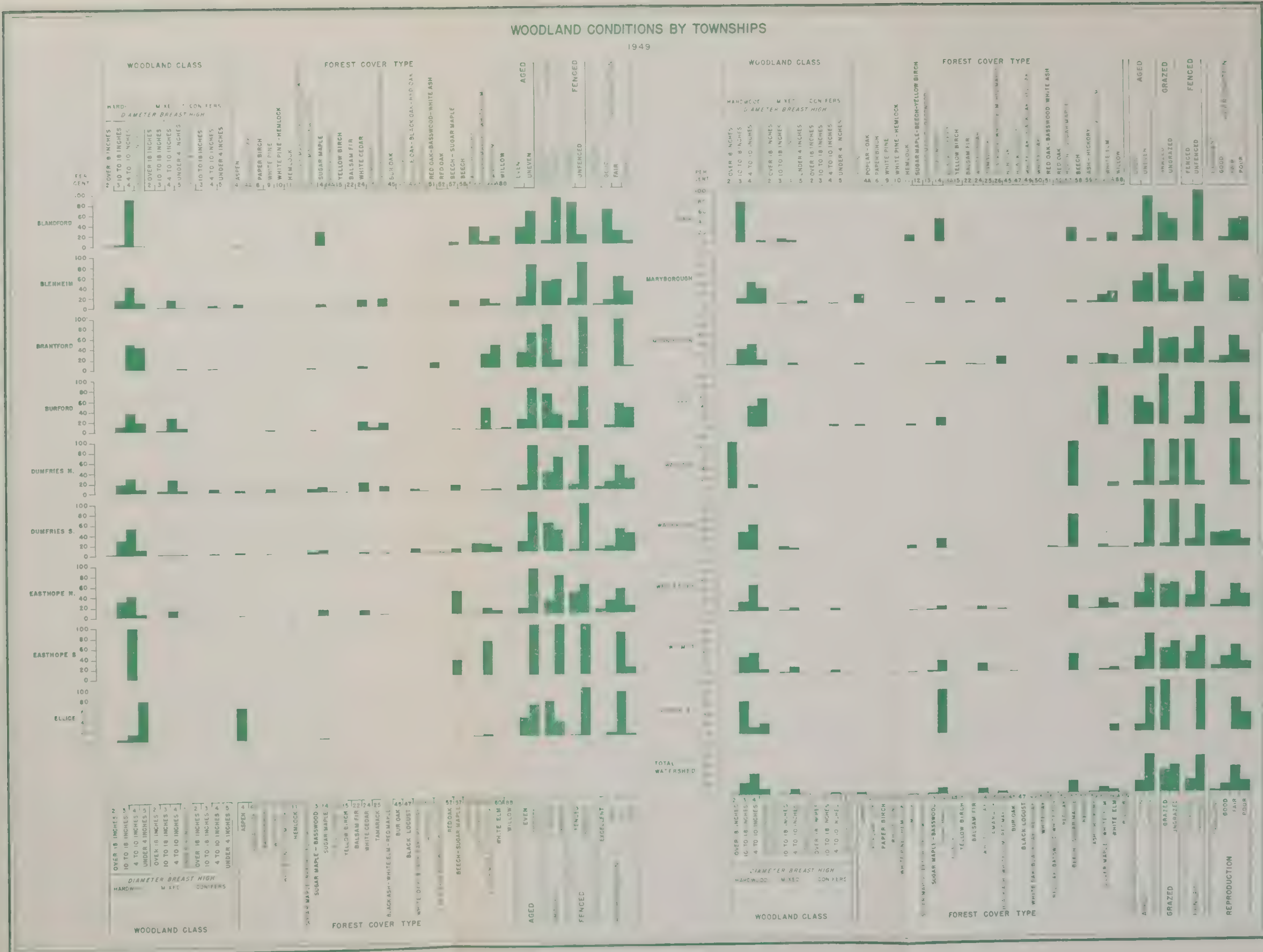
1. Forest Cover Types of the Eastern United States - Report of the Committee on Forest Types, Society of American Foresters, 1940.


WOODLAND CONDITIONS BY TOWNSHIPS
1949
WOODLAND CLASS
FOREST COVER TYPE
AGED
GRAZED
FENCED
REPRODUCTION
BLANDFORD
BLENHEIM
BRANTFORD
BURFORD
DUMFRIES N.
DUMFRIES S.
EASTHOPE N.
EASTHOPE S.
ELLICE
MARYBOROUGH
TOTAL WATERSHED

No classification of forest cover types has been made in Canada for Southern Ontario so the system used is a slightly modified form of that drawn up by the Society of American Foresters which covers the whole of the Eastern United States, consequently there are many types in their classification which do not enter Canada and this accounts for the gaps in the numerical listing of types occurring in the Nith Watershed. The forest cover types of the Nith Watershed may be listed as follows:

Number	Name
4	Aspen
4A	Poplar-oak
6	Paper birch
9	White pine
10	White pine-hemlock
11	Hemlock
12	Sugar maple-beech-yellow birch
13	Sugar maple-basswood
14	Sugar maple
14A	Black cherry
15	Yellow birch
22	Balsam fir
24	White cedar
25	Tamarack
26	Black ash-white elm-red maple
45	Bur oak
47	Black locust
49	White oak-black oak-red oak
50	White oak
51	Red oak-basswood-white ash
52	Red oak
57	Beech-sugar maple
58	Beech
59	Ash-hickory
60	Silver maple-white elm
60A	White elm
88	Willow

Type 4 Aspen

Aspen is a pioneer type coming in after fire or overgrazing. Though it avoids the wettest swamps it does grow on soils that are wet throughout a good part of the year, as well as on dry soils. Its associates may be white elm, paper birch, red cherry and balsam poplar with occasionally large-toothed aspen and green ash. It forms almost 6 per cent of the woodland of the watershed.

Type 4A Poplar-Oak

This is a residual type on the light soils of

the moraines following logging and fire. The oak usually consists of trees of white, red and sometimes bur oak which have survived due to their resistance to fire and poplar, either trembling or large-toothed, which has seeded in later. The site is usually a white pine site and scattered trees of this species frequently occur with patches of good white pine reproduction appearing through the area. It includes only eight acres of the woodland.

Type 6 Paper Birch

This is a pioneer type of clear cut and pastured areas succeeded by other northern hardwood types or white pine. Its associates include small proportions of aspen, white pine, hemlock, red maple, red oak and basswood. Frequently an understory of conifers or tolerant hardwoods develops. It occurs on sandy soils but is rare on the Nith Watershed, only five acres having been mapped.

Type 9 White Pine

White pine typically occurs on fresh, sandy loam upland but also on clay, in swampy areas and on loamy sand. On sandy soils on the moraines it tends to be permanent but on heavier soils it is usually succeeded by sugar maple - beech, red oak - basswood - white ash, white pine - red oak - white ash, white pine - hemlock, sugar maple - basswood or white oak.

Its associates on light soils are aspen, red maple, pin cherry and white oak, on heavier soils yellow birch, black cherry, white ash, red oak, sugar maple, basswood and hemlock. It was never very abundant on the watershed and now occupies only one-half of one per cent of the wooded area. Most of this is in North Dumfries Township.

Type 10 White Pine - Hemlock

Associated with this type are many species but none is particularly characteristic. The principal ones are beech, sugar maple, basswood, red maple, yellow birch, black cherry, white ash, paper birch and red oak. It occurs on a range of sites from sand plains to heavy upland soils, but

favours cool locations such as the slopes of ravines. It constitutes only 11 acres of the woodland.

Type 11 Hemlock

This type occurs mostly in widely scattered bodies in cool locations, moist ravines and north slopes, frequently in the sugar maple-beech type. Its associates are beech, sugar maple, yellow birch, basswood, red maple, black cherry, white ash, white pine, paper birch and red oak. It makes up a little over one per cent of the remaining woodland of the Nith Valley but was never abundant because of its preference for cool ravines of which not many exist. It occurs mostly in Wilmot and Wellesley Townships.

Type 13 Sugar Maple - Basswood

This is a fairly important type occurring on loamy, upland soils. Its associates are white elm, green ash, yellow birch, white pine and red oak with ironwood and blue beech as subordinates. It forms two and one-half per cent of the woodland of the watershed and the percentage is probably being continually reduced as basswood is a more sought-after species than sugar maple.

Type 14 Sugar Maple

This type undoubtedly originally covered a considerable part of the watershed but since it occupied fertile, well drained soil with good moisture much of it has been cleared for agriculture. A small proportion of other species such as yellow birch, white ash, red and white oak may be present. Today it covers over 12 per cent of the wooded area. Its area may have been increased in recent years by the removal of beech from Type 57.

Type 14A Black Cherry

This type is not common but second growth stands occur usually on fertile, moist, well drained soils, frequently those formerly occupied by hemlock. Its associates may be sugar maple, red oak, red maple, white ash, basswood, butternut, white elm and hemlock. Only 47 acres were found on the

Tpe 49 White Oak, Bck Oak, Red Oak: s type belongs to Deciduous Forest gion and occurs on nt soils in Blenheim d North and South mfries Townships, ere it reaches the thern limit of its ge.

pe 4 Aspen: Aspen pioneer type, com- in after fire and rgrazing. It forms nost 6 per cent of woodland.

Type 24 White Cedar: Cedar has survived fairly well in the depressions of the moraine. In most cases the stands have been overcut. They should be carefully managed because of their value as a source of posts and poles.

Nith Watershed, mostly in North Dumfries Township.

Type 15 Yellow Birch

This type is really an intrusion from further north and occurs only in the cool swamps of the glacial melt-water channels; its associates are balsam, white cedar, hemlock and red maple. It is of minor importance and comprises only 25 acres.

Type 22 Balsam Fir

Like Type 15 balsam fir is an intrusion from the forests further north and reaches its southern limit in Maryborough, Mornington and Wellesley Townships where 70 acres were mapped though the species is found in the glacial drainage channels further south; its associates are yellow birch, red maple, black spruce, tamarack, black ash and white cedar.

Type 24 White Cedar

The associates of this type are tamarack, yellow birch, paper birch, black ash, red maple, white pine and hemlock. It occurs on sites of slow drainage which are not strongly acid, including the muck soils of the watershed, and is also present on poor pasture land and bottom land. It forms over 10 per cent of the woodland and is the chief source of fence posts and poles.

Type 25 Tamarack

Tamarack occurs in muck swamps with little or no drainage associated with white cedar and less commonly with red maple, black ash and aspen. The trees are small and have grown since the near extinction of the species in the early part of the century. No extensive areas existed in the past and today it occurs on only four acres.

Type 45 Bur Oak

This is a very uncommon type in Ontario, the associates of which are red oak, white oak or black oak, and occurs on loamy slopes with south or south-west exposure. Only eight acres are present on the Nith Watershed.

Type 47 Black Locust

This species does not occur naturally in Ontario but has been planted fairly extensively, largely for erosion control purposes. It grows best on dry sites, especially on limy soils. One acre was mapped on the Nith drainage area.

Type 49 White Oak - Black Oak - Red Oak

This type belongs to the Deciduous Forest Region and occurs on light soils in Blenheim and North and South Dumfries Townships. Being at the limit of the region black oak may be absent. Associates are bur oak, shagbark or bitternut hickory, white or green ash, sugar maple and occasionally a few black cherry, butternut or large-toothed aspen. Two hundred and eighty-nine acres still exist on the Nith Watershed.

Type 50 White Oak

The chief associates in this type are black oak and shagbark hickory. It also belongs to the Deciduous Forest Region and occurs on light soils, mostly in Blenheim and North and South Dumfries Townships. There are 94 acres in all.

Type 51 Red Oak - Basswood - White Ash

Associated with the type species are red maple, yellow birch, aspen, sugar maple, paper birch and beech on well drained soils. This is not an important type, there being only 72 acres in the watershed.

Type 52 Red Oak

Red oak may be pure or associated with white oak on ridges in park-like stands. The trees are short-trunked and flat-topped. About 27 acres occur throughout the south part of the watershed.

Type 57 Beech - Sugar Maple

This is regarded as the typical association of the climax with red maple, white oak, red oak, hemlock, white elm, red elm, basswood, shagbark hickory and black cherry. This type was undoubtedly very extensive in the Nith Watershed but, because it occupied the best land, its area has been

Type 57 Beech-Sugar Maple: This type was undoubtedly very extensive on the Nith Watershed but, because it occupied the best land, its area has been greatly depleted. It still comprises 23 per cent of the remaining woodland.

Type 14 Sugar Maple: Like Type 57 this covered a considerable part of the watershed but, since it occupied well drained soil with good moisture, much of it has been cleared for agriculture. Today it covers over 12 per cent of the wooded area.

Type 60 Silver Maple-White Elm: This is a type of meltwater channels and poorly drained soils which has survived better than most forest cover types on better land. With the similar type 60A white elm it occupies over 20 per cent of the woodland.

tremendously depleted. However, it still comprises over 23 per cent of the remaining woodland, the greatest part of which is in Wilmot and North Easthope Townships.

Type 58 Beech

This type also belongs to the Deciduous Forest Region and is, theoretically, the ultimate dominant of the climax but it is almost invariably associated with sugar maple Its other associates are red maple, red oak, white ash, white elm, red elm and bitternut hickory. Sixty-nine acres were mapped in the Nith drainage area. A few areas were encountered where the type had originally been 57 and the sugar maple taken out for logs leaving the inferior beech.

Type 59 Ash - Hickory

This type is not listed in the American classification but has been introduced because of its frequent occurrence in Southern Ontario. It is usually a residual type following cutting, often of Type 60 silver maple - white elm, though it may occur on any poorly drained, cutover area. It is usually composed of a mixture of white, green or red ash and shagbark and bitternut hickory with bur oak, cottonwood, blue beech and ironwood as associates. It constitutes over two per cent of the woodland.

Type 60 Silver Maple - White Elm

This is a type of meltwater channels and poorly drained soils unsuitable for general farming unless completely and adequately underdrained; for this reason it and the similar white elm Type 60A have survived better than forest cover types on better drained land. Associated species are red maple, slippery elm, cottonwood, white, red and green ash, bur oak and bitternut hickory. This type represents over 12 per cent of the woodland of the watershed and is the second most abundant type.

Type 60A White Elm

Type 60A is very similar to the silver maple - white elm Type 60, but is found on drier sites as well as

EXISTING WOODLAND

swamps and swales and its associated species are the same. It is not listed in the American classification but has been introduced here because of its frequent occurrence in Southern Ontario. It comprises over eight per cent of the woodland so that these two types together make up over 20 per cent of the total woods in the watershed.

Type 88 Willow

Several species are included in this type but the commonest is black willow. It occurs on wet sites, often on the margins of kettles and includes 79 acres on the Nith Watershed.

The large map shows the distribution of all types throughout the watershed and from it the following observations may be made:

(a) Elm swamp types which covered extensive areas have survived pretty well throughout the watershed on level land and in the glacial meltwater channels.

(b) Cedar and tamarack swamps which were scattered along the valleys of streams have been severely overcut and pastured but fairly extensive areas still exist.

(c) Sugar maple types are still the most abundant and are found generally throughout the watershed, with the highest concentrations in Wilmot, North Easthope, Wellesley and Blenheim Townships.

(d) The chief pioneer type following cutting and pasturing is aspen Type 4 which covers light soils on the moraines.

(e) The forest types of the Deciduous Forest Region may still be seen along the south and south-east fringe of the watershed.

3. Present Conditions

The results of the forest surveys are summarized in the accompanying table.

Woodland within the watershed comprises 22,516 acres which is 8 per cent of the total area of 276,576 acres.

TOWNSHIP	NO. OF WOODLOTS	NO. OF ACRES	WOODLOT CLASS									
			H2	H3	H4	H5	M3	M4	M5	C3	C4	C5
Wallace	2	22	20		2							
Maryborough	69	742		99	326	237	17	8	40		15	
Peel	5	53			22	29					2	
Elma	8	36		29		2	3	2				
Mornington	189	1,323	54	442	575	159	15	63	14	1		
Wellesley	299	2,813	71	550	1,423	252	91	191	24	11	158	42
Ellice	23	629		32	98	499						
Easthope N.	267	2,703	34	915	1,147	177	11	368	16	4	30	1
Easthope S.	3	19			19							
Zorra E.	3	14		9	2	3						
Wilmot	583	5,732	80	1,751	2,302	439	124	607	63	10	274	82
Waterloo	47	298		109	151	5	18	14	1			
Blandford	8	49		3	45	1						
Blenheim	575	4,508	30	795	1,847	498	109	753	158	11	227	80
Dumfries N.	227	1,905	2	352	570	173	101	476	90	19	117	5
Dumfries S.	185	1,284	22	379	685	139	9	14	10		26	
Burford	44	283	3	30	104	53	8	67	18			
Brantford	10	103			52	46			3		2	
TOTALS	2,547	22,516	316	5,495	9,370	2,712	506	2,563	437	56	851	210
PER CENT		100.00	1.40	24.40	41.61	12.05	2.25	11.38	1.94	0.25	3.78	0.94

H -- HARDWOOD -- 80% or more of the main stand composed of hardwoods.

C -- CONIFEROUS -- 80% or more of the main stand composed of conifers.

M -- MIXED -- All other stands.

Diameter Breast High	Hardwood	Mixed Wood	Coniferous
Virgin	H-1	M-1	C-1
Over 18"	H-2	M-2	C-2
10 to 18"	H-3	M-3	C-3
4 to 10"	H-4	M-4	C-4
Under 4"	H-5	M-5	C-5

alsam Fir: Balsam fir aches the southern mit of its range on e poorly drained till ain in Mornington ownship, but is also und in patches in the acial spillways fur- er south.

ed Cedar: Red Cedar long with sassafras nd black oak are ound in the vicinity f Galt.

Hackberry: Hackberry is common in the river bottoms, as is syca- more at the south end of the watershed.

The total number of woodlots examined was 2,547 which includes many areas which are considered by their owners as constituting a single woodlot but which, because of the difference in types and age classes of certain sections, had to be considered in the field as separate units. Conversely, where property boundaries were not marked, woodland extending across two or more properties was sometimes considered as a unit because the type and age class remained constant throughout.

The conifers occurring in the watershed are white pine, hemlock, white cedar, tamarack and balsam fir. Red pine occurred in the original forest but no trees were found in the natural state at the time the survey was made. White pine is fairly generally scattered throughout the moraine areas, especially in the south-east. Hemlock is found mixed with hardwoods and white cedar and tamarack are present in the small swamps. Balsam fir is of fairly common occurrence in the northern third of the watershed and is found further south in the swamps of the glacial meltwater channels. There is no doubt that conifers formed a larger part of the woodland than they do today, but their numbers have been diminished because of the desirability of the lumber they furnish and in the moraines recurrent fires have destroyed them while more fire-resistant species such as oak have survived. The situation at the present time is that of the 22,516 acres of woodland, 80 per cent is classified as pure hardwoods, 16 per cent as mixed woods and 4 per cent is classified as pure conifers. In the 80 per cent classified as hardwoods, 1 per cent is over 18 inches in diameter at breast height, 24 per cent is 10 to 18 inches, 42 per cent is 4 to 10 inches and 12 per cent is young growth under 4 inches in diameter at breast height.

In the mixed wood classes, comprising 20 per cent of the woodland, 2 per cent is 10 to 18 inches in diameter at breast height, 11 per cent is 4 to 10 inches while 2 per cent is young growth under 4 inches. In the coniferous woods 4 per cent is second growth, 4 to 10 inches DBH and less than

1 per cent is young growth under 4 inches.

For the whole area the percentage of uneven-aged stands is considerably more than the even-aged, the figures being 77 per cent of the former and 23 per cent of the latter.

Grazing in farm woodlots is still fairly general, the percentage of grazed woodland being 45 per cent for the whole watershed but the percentage of grazed woodlots is low compared with other watersheds. Grazing, as is well known, is detrimental to the proper development of any area. The number of cattle and the size of the woodlot have a direct relationship to the damage which is done. For example, a large woodlot is not as seriously affected by a few head of cattle as a small one, but on most farms the woodlot is small and is seriously damaged by large herds. Grazing in a woodlot destroys young growth, open areas appear and become covered with grass, which means that the maintenance of the forest floor, which is so important to the health of the stand, is interfered with and there is less likelihood of a renewing of the stand by reseeding from old trees. These in turn become stag-headed and are easily preyed upon by fungus and disease.

Fire is a factor menacing woodlands in the moraine area and the Ellice Swamp. It is not necessary to burn a tree to kill it. Merely raising the temperature of the growing layer inside the bark to 150 degrees Fahrenheit will do the job and this is frequently what happens.

Due to the custom of grazing in the woodlots some stands have become open and require some planting. Of the areas examined 24 per cent are devoid of natural regeneration and 70 per cent require some planting to bring them back to fully stocked stands. Cutting in woodlots and clean-cutting of whole areas has been carried on persistently in the past but since all the counties of the watershed now have diameter limits this practice has now ceased.

To sum up, 85 per cent of the woods are second growth with a mixture of large trees in many cases and 15 per

cent are young growth, the former ranging from 30 to 50 feet in height. The lots containing the largest trees are composed of old hardwoods, elm, soft maple in the swamp areas and sugar maple, beech and basswood on dry sites; a fair proportion have been well cared for for a number of generations in contrast to most other parts of Southern Ontario. This is undoubtedly due to the influence of the German settlers in this region who brought with them from the homeland the knowledge and skill acquired there in managing woodlands as a vital part of the farm economy.

CHAPTER 4

FOREST CONSERVATION MEASURES IN PROGRESS

Because the topography of the Nith Watershed varies from the flat, poorly drained land of the till plain in the north to the rough land of the moraine in the south, there are a number of different sites which should be reforested, but to date tree planting has been confined almost exclusively to the light soils of the moraine because they are the easiest to reforest and good results are more easily achieved.

1. Private Planting

The free distribution of trees for planting was first begun in Ontario in 1905, and the following year a statute was passed which enabled a township council to exempt a part of the woodland of a farm from taxation; it provided that exemption be extended to:

"Any part of a farm used for forestry purposes or being 'Woodlands'; provided that such exemption shall not be greater than one acre in ten acres of such farm and not more than twenty acres held under a single ownership".

"'Woodlands' for the purpose of this paragraph shall mean lands having not less than four hundred trees per acre of all sizes, or three hundred trees, measuring over two inches in diameter, or two hundred, measuring over five inches in diameter (all such measurements to be taken at four and one-half feet from the ground) of one or more of the following kinds: White or Norway Pine, White or Norway Spruce, Hemlock, Tamarack, Oak, Ash, Elm, Hickory, Basswood, Tulip, (white wood); Black Cherry, Walnut, Butternut, Chestnut, Hard Maple, Soft Maple, Cedar, Sycamore, Beech, Black Locust, or Catalpa, or any other variety which may be designated by Order-in-Council, and which said lands have been set apart by the owner with the object solely, of fostering the growth of the trees thereon and which are not used for grazing livestock". - R.S.O. 1927, c. 238, s. 4, para. 25; 1934, c.1, s.4 (3).

TREES DISTRIBUTED FOR PLANTING

DEPARTMENT OF LANDS AND FORESTS FIGURES

PRIVATE PLANTING

YEAR	BRANT	OXFORD	PERTH	WATERLOO
1905-1912	40,100	10,785	33,195	20,730
1913-1925	138,619	151,271	93,817	136,385
1926	53,235	82,464	61,522	66,562
1927	61,641	88,698	72,184	73,170
1928	83,404	152,971	95,747	97,004
1929	69,057	127,296	72,847	134,768
1930	92,769	156,119	111,312	155,765
1931	133,457	137,895	86,468	142,986
1932	171,269	243,637	85,589	143,458
1933	160,025	233,377	120,322	162,898
1934	180,019	218,526	88,839	175,523
1935	168,863	219,058	103,548	169,865
1936	126,939	274,464	105,687	157,444
1937	161,433	268,275	126,281	228,812
1938	162,574	316,044	83,590	151,910
1939	341,941	368,043	223,054	188,007
1940	209,893	407,948	121,971	184,606
1941	188,469	342,736	100,990	134,342
1942	261,430	272,510	98,430	127,514
1943	272,757	293,012	97,783	177,145
1944	185,200	211,535	64,683	161,060
1945	120,613	176,499	53,757	134,831
1946	233,809	274,181	96,992	218,416
1947	121,534	113,699	70,186	132,715
1948	145,083	251,007	69,746	207,468
1949	105,215	162,100	110,364	180,864
TOTAL	3,988,348	5,553,650	2,448,886	3,864,248

COUNTY FORESTS AND OTHER MUNICIPAL PLANTING

YEAR	BRANT	OXFORD	PERTH	WATERLOO
1913-1925	25,800	6,525	-	41,625
1926	5,000	-	-	1,000
1927	2,400	-	17,000	7,200
1928	-	9,000	1,775	13,550
1929	4,100	24,000	14,600	10,250
1930	-	15,000	46	8,700
1931	79,125	10,700	-	38,700
1932	18,470	10,689	375	17,300
1933	4,100	4,975	1,500	55,050
1934	86,000	7,000	450	19,595
1935	40,650	6,300	16,800	66,450
1936	55,200	1,600	12,300	33,800
1937	75,950	700	18,400	64,000
1938	37,645	1,300	14,500	16,850
1939	51,565	17,237	5,300	17,500
1940	31,815	11,500	1,300	26,500
1941	16,200	1,600	4,450	6,775
1942	17,500	9,700	4,200	18,000
1943	12,200	3,508	10,650	15,250
1944	17,775	60,700	15,700	24,450
1945	5,350	11,206	7,400	136,950
1946	2,300	144,250	9,250	166,700
1947	44,100	36,500	14,795	138,750
1948	34,580	13,850	150	58,216
1949	3,910	16,100	60,548	104,174
TOTAL	667,735	423,940	228,679	3,045,248

TREES FOR SCHOOLS

YEAR	BRANT	OXFORD	PERTH	WATERLOO
1933	1,000	-	424	3,071
1934	310	881	2,050	11,627
1935	400	370	875	9,665
1936	67	4,925	-	6,274
1937	1,465	19,010	78,782	4,855
1938	120	4,222	53,262	9,312
1939	862	36,740	23,993	9,099
1940	754	30,051	74,191	4,746
1941	23,676	37,953	11,905	4,796
1942	26,710	41,550	13,825	4,838
1943	4,239	216,410	172,672	122,282
1944	57,565	104,900	77,634	135,000
1945	75,142	141,556	86,734	162,287
1946	55,745	48,161	30,945	90,651
1947	-	3,460	-	10,530
1948	-	-	350	-
1949	1,250	725	1,231	3,997
TOTAL	249,305	690,914	628,873	593,030

In 1927 the exemption of taxation on woodland was made compulsory if applied for, and is interpreted as meaning planted as well as natural trees.

In 1938 the Assessment Act was amended to prevent assessment being raised on land after it has been reforested and now reads as follows:

"Land which has been planted for forestation or reforestation purposes shall not be assessed at a greater value by reason only of such planting." - The Statute Law Amendment Act, 1928, C. 37, s. 2 (1).

Both these Acts were designed to facilitate the planting of trees on private land and should be taken advantage of by citizens anxious to improve woodland conditions on their own property, and at the same time benefit the whole community of the river valley.

For some years now, the Department of Lands and Forests has divided Southern Ontario into zones, each with its "Zone Forester" whose duty it is to give advice and assistance to private individuals and municipalities on the management of their woodlands and the establishment of plantations. The Nith Watershed is included in two zones, that is the Counties of Perth and Oxford are covered by the office at Stratford while Brant, Waterloo and Wellington are handled by the Galt office. The Zone Forester's job is to supervise the establishment of county forests, demonstration and school plots and to help individuals with their woodlot and reforestation problems.

The nearest forest tree nursery to the Nith Watershed is that at St. Williams in Norfolk County which was established in 1908, and has served as the largest production and distribution centre for trees ever since. Today, 42 years later, the Norfolk Provincial Forest Station of 3,800 acres presents a magnificent young forest of pines and other species This station also maintains a small sawmill, in which thinnings from improvement cuttings are being manufactured into

materials for local use. Thousands of visitors go to this beauty spot and a small park is provided for their accommodation. Many officials of municipal and other organizations from all parts of the Province have visited this station and returned convinced that all the waste areas of the Province should be reforested and so made useful and beautiful.

The following table shows the number of private plantations by townships. These vary from one to eleven acres in area and the townships not listed have no private plantations within the watershed.

Township	No. of Plantations	Total Area in Acres
Blenheim	22	39
Brantford	4	4
Burford	1	1
Dumfries North	22	53
Dumfries South	3	4
Easthope North	3	5
Mornington	6	16
Waterloo	2	3
Wellesley	13	31
Wilmot	27	71
Total	103	227

The accompanying table shows the total numbers of trees distributed for planting on private land in the counties lying partly within the Nith Watershed since the Provincial Government first began to distribute trees for this purpose in 1905. The total number of trees in the Counties of Brant, Oxford, Perth and Waterloo is given as 15,855,132, but it is impossible to estimate how many were actually planted within the watershed. However, on the basis of area an estimate of 2,660,000 might be made.

The total acreage of private plantations of over one acre in extent existing today is 227, which would

ivate Planting: ınting of gravelly ls and knobs is good nd use.

unty Forests: Most unties in the water-ed are establishing ests in tracts of one ndred, two hundred more acres. There 2,700 acres in the inity of the Black ver which should be luded.

Gully Erosion: Gully erosion on Lot 12, Con. XI, Blenheim. Many such areas on the moraine are in need of reforestation and other erosion control measures.

require 274,370 trees spaced six feet by six feet apart. If we take into consideration the fact that large numbers of the trees would be used for replacing losses on established plantations, for planting open areas in woodlots and for the establishment of shelterbelts and windbreaks, it is apparent that large numbers have been lost through various causes, chief among which are lack of protection from cattle, planting on soils unsuited to the species used and to lack of care of young plantations to eliminate competition from weeds and damage by mice. This loss is now being greatly reduced by a much closer examination of applications for trees and inspection of planting sites by the Zone Foresters.

2. County Forests

The County of Hastings was the first in the Province to interest itself in reforestation and as long ago as 1911 appointed a reforestation committee which was instrumental in having the Counties Reforestation Act passed. The committee also recommended[1] that "The Corporation of the County of Hastings purchase from the municipality of the Townships of Elzevir and Grimsthorpe certain lands containing 2,800 acres, more or less, for $200" as the nucleus of a county forest. However, no further action was taken and the Act lay dormant till 1922 when the present policy of county forests was laid down. This work is done under the authority of The Municipal Reforestation Act (R.S.O. Chap. 323), which provides for the purchasing of land and the entering into agreements by the county for the management of such lands. No limit as to the size of the area is stated so that some counties have plots of a few acres, while others have forests of several thousand acres. If, however, a county wishes to enter into an agreement with the Minister of Lands and Forests for the planting and management of such county-owned land, the policy has been that the county must purchase not

1. Minutes of the Meeting of the Council of the County of Hastings, December 8, 1911.

less than 1,000 acres. The agreements which are in force at the present time run for a period of 30 years, during which time the Ontario Government agrees to establish the forest, and pay the cost of such items as fencing, buildings, equipment, labour, maintenance, trees, etc., in short, everything connected with the management of the forest.

At the end of the 30 year period, the county has the privilege of exercising one of three options: First, to take the forest over from the Government and pay back the cost of establishment and maintenance; second, to relinquish all claim to the forest whereupon the Government will pay to the county the cost of the land, without interest; third, the forest may be carried on as a joint undertaking by the Province and the county, each sharing half of the cost and half the profits.

It will be seen from the above summary of the agreement that all a county stands to lose on such a project is the interest for 30 years on the purchase price of the land. Also, it should be pointed out that, in drawing up such a liberal scheme, it was done purposely to encourage the re-forestation of land not suited to agriculture. Again, it was not the intention of the Government to have the counties stop at a minimum of 1,000 acres as the overhead necessary on an area of this size could very easily be spread over an area of five, or even ten times, the size. As a matter of fact this is what happened in some counties where the councils have initiated a progressive reforestation policy.

This Act has recently been amended so that municipal councils of townships shall have all the powers, privileges and authority conferred on councils of counties except that instead of issuing debentures to an amount not exceeding $25,000, they shall have power to levy, by special rate, a sum not exceeding $1,000 in any year, for the purpose of providing for the purchase of land for planting and protecting the timber thereon.

The agreement which has recently been drawn up etween the Ganaraska Authority and the Ontario Government to stablish and manage the Ganaraska Forest is substantially the ame as that made with the counties, except that the Government as agreed to pay half the cost of the land and the agreement or planting and management is to run until the year 2000 A.D.

All counties partly within the watershed have stablished the beginnings of county forests in isolated compartments which are gradually being extended in area. Existing orests are as follows:

COUNTY FORESTS

County Compartment	Within Nith Watershed	Outside Nith Watershed
Brant 1	-	50
Oxford 1, 2, 5, 6, 7	-	584
Hall Tract 3, 4	200	-
Perth	-	100
Waterloo 1, 2, 3, 5	-	433
Petersburg Tract 4	100	-
Wellington 1 to 7	-	858
Glen Allan Tract 8	100	-
Total	400	2,025

Most of the above counties are expanding their forests regularly and the trees are growing well. Perth County has, however, made no further acquisitions to its original purchase of 100 acres in the Gad's Hill Swamp and this property has now been purchased by the Thames Valley Authority.

3. Municipal Forests

No municipal forests, apart from county forests, have been established in the Nith Watershed. The City of Galt has in Victoria Park a fine piece of woodland which was presented to it some years ago. This is being well cared for and could be managed on a selective cutting basis. Many of the smaller areas recommended for acquisition by the Authority would make excellent municipal forests and there is no reason

why some of these should not be set up as such by local towns or townships.

Assistance with regard to the establishment of municipal forests and the supplying of free trees is still the policy of the Department of Lands and Forests. Moreover, as provided by the amendment to the Counties Reforestation Act, it is possible for a township council to enter into an agreement with private landowners for the reforestation of their property.

The amendment permits the council of a township to enter into agreements with the owners of land providing for the reforestation of portions of such lands. The agreements will prescribe the cutting conditions of all trees planted and such conditions will be subject to the approval of the Minister of Lands and Forests.

"Provision is also made for exempting such lands from taxation and for making arrangements with the Dominion and Provincial Ministers of Labour regarding conditions of labour and payment of wages in connection with planting and conservation of such areas." -- The Municipal Reforestation Act, S. O. 1945, Ch. 14.

Before leaving the subject of municipally-owned forests and forests which provide the local communities with at least a part of their livelihood, it would be as well to review what is being done along these lines in other places.

In Nova Scotia there is a community living on Hammonds Plains near Halifax which depends entirely on wood taken from small woodlands for its livelihood. In this settlement the largest woodlot is not over 400 acres in extent and because of the rocky nature of the soil the people are not able to augment their incomes by farming, though most families own a cow, a pig and some chickens. The wood from the woodlots is manufactured into barrels and boxes by more than 20 small mills which are largely family owned and operated. The people are thrifty and industrious; they have comfortable

homes, are public-spirited and extremely forest fire conscious. This is a community which has developed naturally and yet resembles communities based on a forest economy which have been planned and established in Europe for a considerable time.

One of the most recent is the forest of Ae in Dumfriesshire, Scotland. It was established by the British Forestry Commission in 1927 and covers an area of 10,683 acres of which 3,000 acres have been planted, 4,500 acres are scheduled for planting in the near future, 250 acres of the best land have been set aside for cultivation and the balance of 2,800 acres is unplantable because of its altitude but is used for sheep pasture in summer.

The forest is in charge of a forester who resides on the spot and under him there are foremen and gangs of workers. In the first year 16 men were employed, just before the war 27 full-time employees were engaged, and by 1960 about 90 men or one man for each 80 acres will be needed the year around for essential forest work. This does not take into account temporary employees who will be required for saw-milling, transport and other jobs. It is planned to create a forest village for the workers embodying a church, a school, playgrounds and sportsfields. The combination of the forest and the village dependent on it is something new in Scotland and represents an important stage in the resettling of men and women in the country. The village is to be the forerunner of other similar villages and in many parts existing villages will be revitalized by the stimulus of forest wealth.

4. Demonstration Plantations

No demonstration plantations have been set out on the Nith Watershed.

The value of such plots, if well cared for, in showing landowners what can be accomplished in a very few years by planting trees is so great that every township should endeavour to establish at least one plot.

These were established under the policy which was laid down by the Government in 1922 when it offered to assist municipalities in the establishment of small forest plantations for the purpose of demonstrating the use of trees on marginal and sub-marginal land. The requirements are that it be on a well travelled road and that the land be owned by the municipality; in return the Government will supply the trees free. It is recommended that all the rural townships within the watershed establish plantations of this nature to serve as demonstrations in each community.

5. Demonstration Woodlots

Demonstration woodlots are privately owned areas of woodland on which the owners have agreed to follow prescribed methods of woodlot management, outlined by the Department of Lands and Forests, under the Zone Forester and to permit access to the area by interested persons. Such demonstration woodlots and the influence they exert for the proper management of similar areas contribute to the total conservation effort in any watershed.

Ten demonstration woodlots have been established in the Nith Watershed as follows:

County	Township	Number
Brant	Dumfries South	1
Oxford	Blenheim	4
Waterloo	Dumfries North	2
	Wilmot	3
Total		10

Two sample plots have been laid out in two of these woodlots where the zone forester is making studies of growth and the effect of thinnings.

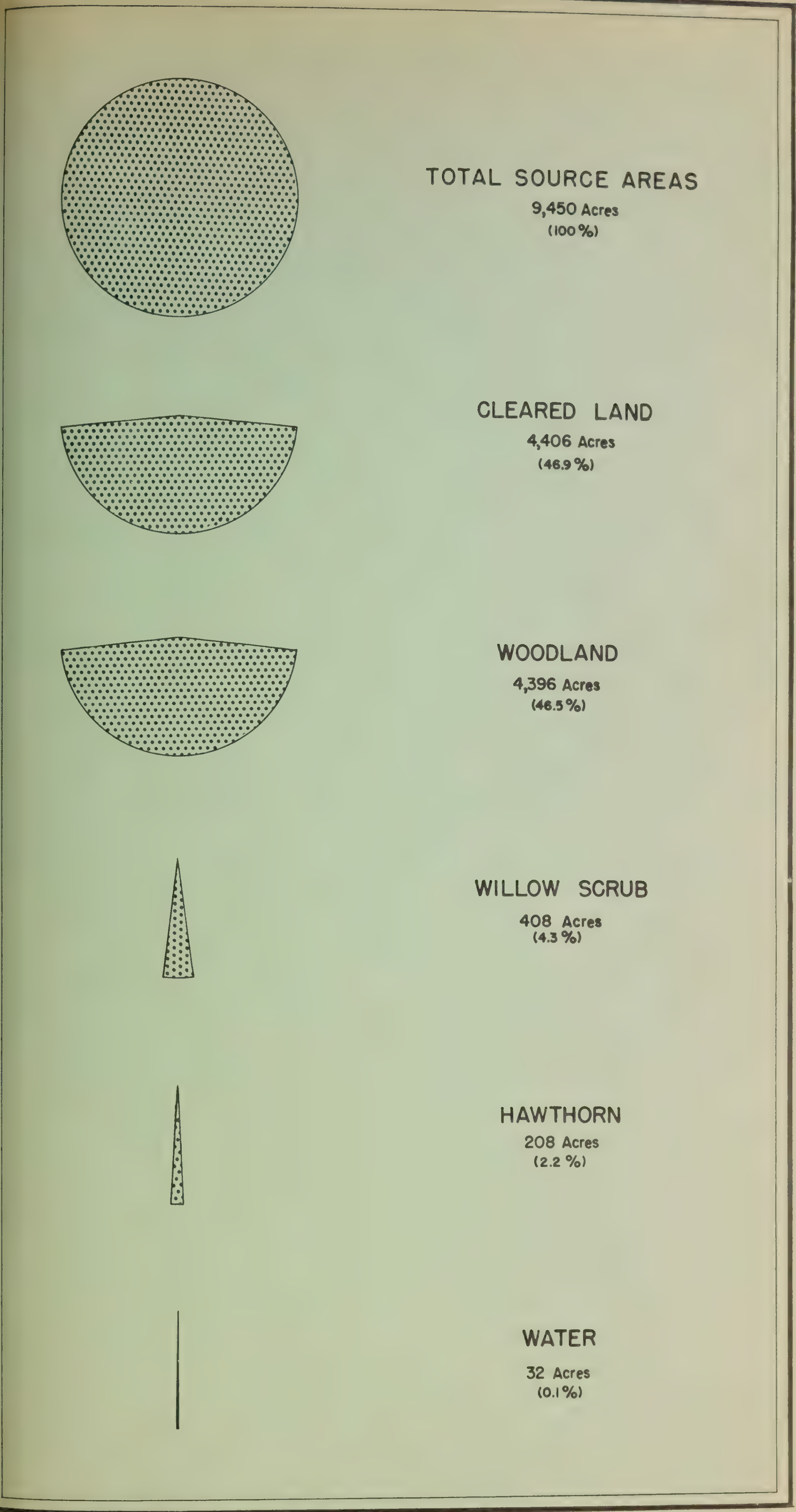
6. School Forests

In order to encourage the establishment of school forests which would be planted and cared for by school children the Ontario Horticultural Association organized an

annual competition in 1945 for which prizes are offered for the school having the best plantation and knowledge of forestry in each forest district. Prizes are provided by the Ontario Conservation Association, and by Mrs. D. W. Boucher of Kingston. The winners in these district competitions are eligible for the Provincial Forestry Competition for which Mr. Jackman of Owen Sound furnishes $100 in prizes.

Many schools in the area have entered these contests in the past and several schools have taken prizes in the Provincial competition.

Trees have also been sent out to schools in the watershed which have been distributed to children for planting on the home farm and many of these have been used to form shelterbelts and windbreaks. The number of trees distributed for this purpose is shown in the accompanying table.



LAND CLASSIFICATION - SOURCE AREAS

CHAPTER 5

FOREST CONSERVATION MEASURES REQUIRED

1. Source Areas and Reforestation Land

The most important conservation measure required on the Nith Watershed is the establishment of forest areas to be called the Nith Forest under the Conservation Authority, which will serve to cover the natural water storage areas of the valley. Seventeen such areas have been defined, as shown in the accompanying table, with the acreages of woodland, willow scrub, hawthorn and open land in each. The page-size map shows the location of these areas and the main tributary streams to which they supply water. The names given to these areas are taken from the streams they feed or from nearby places. The large folding map gives more detail, showing the present tree cover, willow scrub, hawthorn and open land within the areas. The total acreage recommended for acquisition as source areas and reforestation land is 9,450 acres of which 4,396 has some form of tree cover, 408 is willow scrub, 208 hawthorn, 4,406 is open land and 32 acres is water contained in small lakes.

(1) Lebanon

The Lebanon area lies at the extreme north end of the watershed on flat, poorly-drained clay land which has been pastured, neglected and become overrun with hawthorn. It is not a big area, including in all only 200 acres, but it is a very suitable area for acquisition by the Authority or the Township of Maryborough.

(2) Dorking

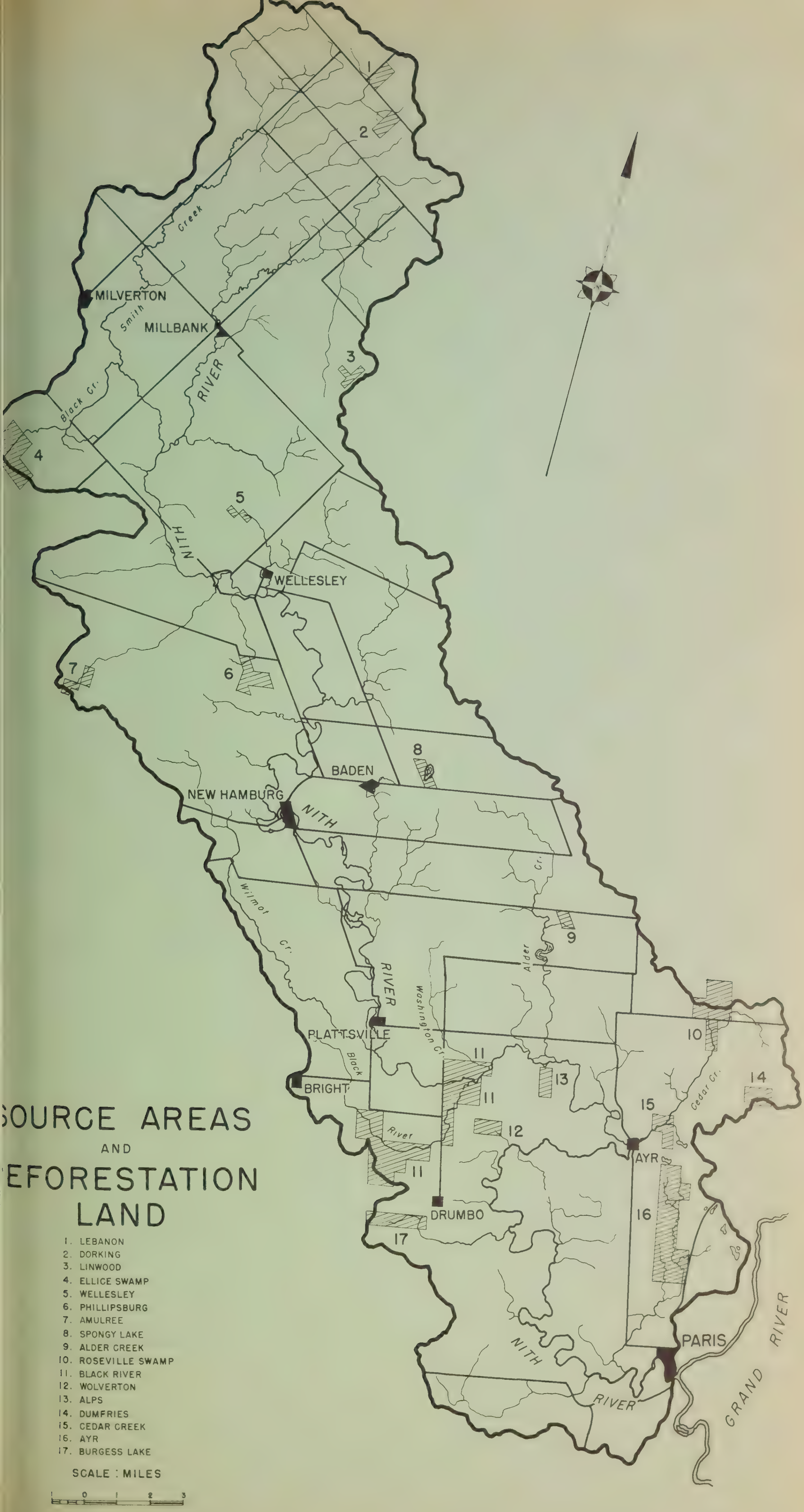
This piece of land is very similar to the Lebanon section but it has considerably more tree cover with 139 acres of woodland and 61 acres of open land. It lies at the headwaters of an intermittent stream and its acquisition would assist in the regulation of stream flow.

(3) Linwood

This, too, is on the level, poorly-drained

SOURCE AREAS AND REFORESTATION LAND

	Woodland	Willow Scrub	Haw-thorn	Open Land	Water	Total
1. Lebanon	17	-	86	97	-	200
2. Dorking	139	-	-	61	-	200
3. Linwood	23	-	-	177	-	200
4. Ellice Swamp	758	229	-	113	-	1,100
5. Wellesley	-	-	-	200	-	200
6. Phillipsburg	273	-	-	127	-	400
7. Amulree	126	-	14	110	-	250
8. Spongy Lake	43	-	-	132	25	200
9. Alder Creek	32	-	-	68	-	100
0. Roseville Swamp	625	5	-	70	-	700
1. Black River Swamp (Oxford County Forest Hall Tract 200 acres in this area)	1,242	127	49	1,282	-	2,700
2. Wolverton	50	-	-	150	-	200
3. Alps	39	6	-	155	-	200
4. Dumfries	247	-	7	46	-	300
5. Cedar Creek	199	-	-	101	-	300
6. Ayr	347	37	52	1,257	7	1,700
7. Burgess Lake	236	4	-	260	-	500
otal	4,396	408	208	4,406	32	9,450


SOURCE AREAS
AND
EFORESTATION
LAND
1. LEBANON
2. DORKING
3. LINWOOD
4. ELLICE SWAMP
5. WELLESLEY
6. PHILLIPSBURG
7. AMULREE
8. SPONGY LAKE
9. ALDER CREEK
10. ROSEVILLE SWAMP
11. BLACK RIVER
12. WOLVERTON
13. ALPS
14. DUMFRIES
15. CEDAR CREEK
16. AYR
17. BURGESS LAKE
SCALE : MILES
1 0 1 2 3
MILVERTON
MILLBANK
Smith
Creek
Black Cr.
NITH RIVER
WELLESLEY
BADEN
NEW HAMBURG
NITH
Wilmot Cr.
Alder Cr.
Cr.
RIVER
Washington Cr.
PLATTSVILLE
Black River
BRIGHT
Cedar Cr.
AYR
DRUMBO
PARIS
NITH
RIVER
GRAND RIVER

section of the till plain and comprises mostly open land, consisting of rundown pasture with 23 acres of woodland. It is close to the height of land between the Nith River and Boomer Creek which flows into the Conestogo. It would prove a very suitable area for the establishment of a municipal forest by the Township of Wellesley.

(4) Ellice Swamp

The Ellice Swamp is the largest natural water-storage area in this region. It lies at the headwaters of two streams both called Black Creek, one of which flows south to join the Avon River, a tributary of the Thames, and the other flows north into Smith Creek which is a tributary of the Nith. This area is vital to the regulation of stream flow and its acquisition ought to be a matter for co-operation between the Upper Thames River Conservation Authority and the Grand Valley Conservation Authority because it lies astride the boundary between them. The swamp is largely composed of peat overlying clay soil and, as is well-known, peat has great water-holding properties. Huge ditches have been cut through this swamp to drain it, the peat has been set on fire almost annually and every effort has been made to get the water out of it as rapidly as possible. The benefits derived from the drainage are in some cases very doubtful and in the summer of 1948 farmers around the margin complained that they had to haul water for their cattle for the first time. Careful consideration should be given to the advisability of closing up some of these ditches and to reforesting the whole region in order to restore its natural water-holding properties. The area recommended for acquisition by the Grand Valley Authority is 1,100 acres of which 758 has a poor type of bush, comprising mostly poplar, 229 acres are willow scrub and 113 acres open land, partly clay, partly peat but all poorly-drained.

(5) Wellesley

This is a small but very important piece of rough land lying just north of the village of Wellesley, from

which issue strong springs, the chief source of water for the Wellesley Pond. It has been almost completely denuded of trees and at present gravel is being extracted from the hillsides. It is strongly urged that this area be acquired as soon as possible and that forest cover be restored as soon as all the gravel has been extracted.

(6) Phillipsburg

The Phillipsburg Swamp is one of the larger wooded swamp areas in the northern part of the watershed. From it there flows a stream which enters the Nith near Lisbon, which dries up in the summertime, but the acquisition of this area is considered important for the preservation of flow in the stream. The area is 400 acres in extent, 273 acres of which is woodland.

(7) Amulree

The Amulree area is another swamp laying across the height of land between headwaters of the Avon River and a tributary of the Nith. This area is vital to the flow of the streams and its acquisition should also be a matter for co-operation by the two Authorities. The section which the Grand Valley Authority should secure is 250 acres in extent with about 126 acres of woodland, 14 acres of hawthorn and 110 acres of open land.

(8) Spongy Lake

Spongy Lake is a kettle surrounded by the steep slopes of the moraine. It lies about one mile east of the village of Baden and the area would make an excellent municipal forest of about 200 acres. Twenty-five acres are occupied by the lake itself, 43 acres are wooded and 132 acres are open land.

(9) Alder Creek

This is an area of springs, lying within the moraine, which feeds minor tributaries of Alder Creek above the pond at New Dundee. It is important to the flow of water in this stream and would also make an excellent municipal forest. It is 100 acres in extent and contains 32 acres of woodland.

(10) Roseville Swamp

The Roseville Swamp lies in a glacial spillway formed by the waters melting from the face of the glacier. It is an area which would be impossible to drain and feeds water to a stream which flows north to join the Grand River at Blair and to Cedar Creek which enters the Nith at Ayr. It comprises in all 700 acres, 625 acres of which have forest cover, 5 acres are willow scrub and 70 acres are open land. It is a most important natural water-storage area essential to the maintenance of flow in both the above streams, and its acquisition by the Authority is strongly urged.

(11) Black River Swamp

The Black River Swamp is the largest and most important water-storage area on the Nith Watershed. It is another glacial drainage channel in which the Black River now flows bordered by low-lying land which it is impossible to drain. On the sides of the drainage channel are morainic hills of light material, mostly suited only to the growing of trees. This area is 2,700 acres in extent, including 1,242 acres of woodland, 127 acres of willow scrub, 49 acres hawthorn and 1,282 acres of open land. The county of Oxford has already purchased 200 acres of sandy soil within this area and reforested 62 acres.

(12) Wolverton

Wolverton is a small area lying north of the village of the same name. It covers about 200 acres of rough pasture land in the middle of which is a cedar swamp where many springs rise which feed a small but important stream. Fifty acres are woodland and 150 acres are open land. This section would make an excellent municipal forest.

(13) Alps

This is another small area on the rough land of the moraine from which a number of springs flow into a small creek. There are 200 acres in all with 39 acres of woodland at the north end, 6 acres of willow scrub and 155 acres of

rough pasture. The woodland is predominantly cedar swamp and its acquisition is considered important to the regulation of stream flow.

(14) Dumfries

This is very largely a wooded area on the height of land where slopes are steep and the woods have been preserved. It includes 300 acres altogether of which 247 acres are woodland, 7 acres are covered with hawthorn and 46 acres are open land.

(15) Cedar Creek

This is mostly a hardwood swamp area containing soft maple, white elm and black ash. It is an important natural water-storage area close to the village of Ayr and would form an excellent municipal forest which might be acquired and maintained by the village or the Authority. Woodland covers 199 acres and the remainder of 101 acres is open land, making a total of 300 acres. The open land is largely run-down pasture.

(16) Ayr

This is the second largest area recommended for acquisition on the Nith Watershed. It borders an excellent stream which flows south to join the Nith River near Paris. Within it is a small lake of about 7 acres, 347 acres of woodland, 37 acres of willow scrub, 52 acres of hawthorn and the remaining 1,257 acres are open land. The open land is very largely pasture and numerous springs feed the stream, particularly in the vicinity of the lake. The acquisition of this area is considered vital to the regulation of stream flow.

(17) Burgess Lake

The Burgess Lake area is a small one of about 500 acres in extent, on the height of land southwest of the village of Drumbo. The land is largely swampy and covered with trees; a small but important stream rises here which flows into Burgess Lake and eventually into the Nith River. The area comprises 500 acres of which 236 acres are woodland,

Damage by Grazing: Cattle destroy all young growth and humus on the forest floor.

Hawthorn: Neglected pasture fields become covered with hawthorn and wild apple.

Hawthorn Shaded Out by Maple: If cattle are excluded for a few years and seed trees are present, sugar maple and other species will grow up and shade out the hawthorn.

4 acres are willow scrub and 260 acres are open land.

Restoration of the forest cover to the land in all these areas would not only serve to protect them, slowing down run-off from the slopes and holding water in the natural water-storage areas of the swamps, but would greatly improve the economy of the whole region by growing timber on land which is otherwise largely unproductive, thus providing work for the local people.

The present cover of these areas is indicated on the map as woodland, open land and scrub land. Woodland, in most cases, will require little work in the near future except that of erecting fences to exclude cattle, but will provide considerable work when labour is more readily available in the production of logs and fuelwood from improvement cuttings. Open land should be planted with trees of suitable species as soon as possible, and planting should be carefully planned beforehand.

2. Willow Scrub Areas

In addition to the open land there are 3,136 acres of scrub land. This is largely poorly-drained land covered with scrub willow though there are some fairly large patches of hawthorn. The willow scrub areas present a problem in planting, and research should be undertaken to determine the best method of handling them. There appears to be a natural succession from neglected pasture land through willow scrub, trembling aspen, white elm and black ash to the climax types of silver maple - white elm or black ash - white elm - red maple and every effort should be made to determine the best method of speeding up this succession.

In addition to the large areas of moraines and sandy land, there are innumerable smaller areas forming parts of farms which will always be in private hands. The aggregate effect of this on stream flow is very considerable. The scrub areas of this type are shown on the forest map and the moraines

and glacio-fluvial material are defined on the soil maps. These should be planted with trees to form part of the farm woodlots where they occur. Many of them should be placed under a reforestation and controlled woodlot scheme by the Authority, especially where they cover the sources of streams. Under this scheme the owner would get considerable help from the Authority in the establishment and maintenance of the woods, but would not be permitted to cut them indiscriminately (see Controlled Woodlot Management).

3. Woodlot Improvement

Improvement work in the woods in addition to planting would include the cutting of large, mature trees, the removal of dead and fallen and trees attacked by disease or infested by insects; defective and crooked trees, weed trees and those having wide, spreading crowns. Such improvement would include the cutting of this material into fuelwood as well as the scattering or burning of brush. Based on figures available for this class of work in other parts of Ontario the time required would amount to sixty man-hours per acre.

4. Controlled Woodlot Management

Before the necessary conservation measures on that part of the watershed exclusive of the proposed watershed forest can be properly co-ordinated, some system of controlled cutting of privately-owned woodlots must be established. The reason for this is that the average owner does not take a broad view of the value of forest cover and is not interested to any great extent in what may happen to land or stream flow off his property. The result is that throughout the watershed there is a systematic cutting of woodlots for the purposes of lumber and firewood. This type of cutting has been in progress for many years, and the portable sawmill has done a great deal of damage in removing, particularly, young, thrifty trees. The system of selling acre or half-acre blocks of timber for fuelwood is also another vicious practice, for the reason that

when a purchaser buys such a block in nearly every case he clean-cuts every tree which can be used down to an inch or two in diameter. Some system of regulating cutting would correct this situation and certainly the areas which are connected in any way with the headwaters of streams, or the feeding of springs, should be controlled to the extent that they cannot be clean-cut.

Where conditions warrant, a certain amount of cutting would be continued, but such trees should be marked by a competent person and provision made for restocking where necessary. The intention would be to interfere as little as possible with the economy of farm property where the supply of wood is concerned, but in some cases it would be necessary to subsidize the owner in the form of supplying him with fuelwood or lumber. A large quantity of such material would be available, however, from thinnings and improvements from the Dith Forest, and could be used in this way.

For many years now conservationists have advocated controlled cutting of woodlots. In some sections, particularly in tobacco-growing counties such as Norfolk County, the destruction of woodlots for the curing of tobacco has become alarming. It is admitted that the question requires delicate handling, but where the good of the whole community is envisaged some middle road of agreement could be arrived at. Furthermore, the distribution of free trees by the government for conservation purposes is sometimes criticized, and rightly so, where on one farm the owner plants an area with seedlings and in the same year his neighbour clean-cuts a woodlot which perhaps protects the headwaters of a stream. In fact, so distorted is the relative value of plantations versus established woodlots in the minds of some people that there are examples on record where municipalities have purchased land for reforestation and have allowed the owner to cut the timber before giving title.

It is admitted, of course, that there are

extenuating circumstances when a farmer may consider it necessary to raise money by selling timber. This, in itself, is not so serious if the cutting is done in such a way that the benefits of the forest are retained. Young forests, as well as old, protect the soil and have water-regulating value.

The basis on which a regulation of this kind should be carried out is a consideration of the woodlot concerned. To make a blanket ruling that all woodlots on the Nith should not be cut, or should come under one type of control measure, would not work to the best advantage of the community and certainly would not be in the interests of good forestry.

Some woodlots have reached the stage in which they are worn out and if the land is good they should be cleared off and cropped. Others may be composed of a high percentage of worthless species and have no relation to water regulation in the countryside, and likewise could be disposed of to advantage. But where the woodland has a direct bearing on water regulation, erosion, retarding of the wind, and similar benefits, the desire of the individual should be sacrificed for the good of the community. The whole question, therefore, resolves itself into an examination of each woodlot by a competent person, and the prescribing of a program of management to suit each case.

5. Fencing Woodlots from Cattle

The most progressive forestry action in Ontario in recent years was taken by the County of Halton in 1948 when the County Council passed a by-law to aid farmers in fencing their woodlots from livestock.

The by-law states that the County of Halton will grant a sum equal to the prevailing cost price of 8-strand fence wire with a single barb (not the cost of posts or labour) to a woodlot owner who will erect such a fence on one or more sides of his woodlot in order to completely enclose the woodlot, thus fostering forest growth by keeping livestock out.

The woodlot must be of a size not less than two acres and livestock must be excluded for a minimum period of ten years.

Such action by the County Council is of infinitely more value than the planting of many millions of trees artificially.

Every county should pass such a by-law and it is recommended that the Conservation Authority adopt a similar scheme.

The basic method of control usually advocated is cutting to a diameter limit; that is, that all trees below a certain diameter - for example, ten inches - should not be cut. Such a regulation may or may not be good forestry. In most cases it would not be because there would be much worthless material below this diameter limit, such as poplar, thorn, willow and other species, which should be taken out. At the same time there would be certain large trees above the diameter limit which should be left for the benefit of the forest, as well as trees suitable for reseeding the area. The diameter limit should not be a fixed rule but simply a guiding principle; a sort of yardstick on which the landowner can base his calculations. In an area the size of the Nith Watershed a program of individual woodlot examination should not be too heavy a burden on the Conservation Authority.

Seventeen counties in all have passed by-laws under the Trees Conservation Act which empowers the council of a county to pass by-laws restricting and regulating the cutting of trees. In each case the by-law has fixed minimum diameter limits below which trees may not be cut except in special circumstances. The object of this is to prevent the cutting of trees at the time when they are putting on their greatest diameter growth. These limits are usually 5 or 6 inches for white cedar, red cedar and black locust and range from 10 inches to 16 inches in the various counties for all other species. The limits which have been set are actually far too low for good forestry practice as most trees are making their

Clear-cut Woodlot: This woodlot was cut clear before the county by-law setting a minimum diameter limit was passed. Nothing is left for the future, and grazing would soon reduce it to hawthorn.

Woodlot Cut to the Diameter Limit: The diameter limit prevents the cutting of small diameter trees, thus leaving trees which will replace the larger ones which have been removed.

Young Growth: Stand of young maple which has grown up naturally on a cut-over area protected from cattle.

maximum diameter growth after they reach 18 inches in diameter, but it is an elementary step in the right direction. Every county should have restrictions of this type and it is recommended that similar powers be extended to Conservation Authorities as a means of protecting existing woodland on their watersheds.

The counties with their diameter limits in inches are listed below:

County	Cedar	Others	
Brant[2]	5	14	Stump 18"
Bruce[2,3,4]	6	12	Stump 18"
Dufferin[5]	5	12	
Durham[6]	5	10	
Elgin[7]	5	12	
Grey[4] (except Keppel Township)	6	12	
Halton[2]	7	14	Stump 18"
Huron[1]	5	12	
Lambton[2]	7	12	Stump 18"
Leeds and Grenville[8]	0	0	
Middlesex[2]	6	14	Stump 18"
Norfolk[2]	6	14	Stump 18"
Oxford[1]	5	12	
Perth[1]	5	16	
Waterloo[1]	5	14	
Wellington[1]	5	12	
York[2,9]	0	14	Stump 18"

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1. Unless otherwise indicated limits are DBH, that is, diameter breast high or $4\frac{1}{2}$ feet above ground.

2. Brant, Bruce, Halton, Lambton, Middlesex and Norfolk limits are 18-inches above ground instead of $4\frac{1}{2}$ feet.

3. Limits apply only in the south half of Bruce County.

4. Bruce and Grey also have an 8-inch limit for poplar and birch.

5. Dufferin has a 10-inch limit on basswood.

6. Durham also has a 5-inch limit for birch, black locust, black ash, soft maple, tamarack and willow.

7. Elgin has a 5-inch limit for black locust.

8. Leeds and Grenville have imposed no limit and the by-law is almost worthless from a forestry point of view.

9. York has no limit on poplar, Manitoba maple, black locust, tamarack, white birch and willow.

Setting the limit at stump height corresponds to a higher limit DBH and has the added advantage of being easier to check after the trees have been cut.

6. <u>Forest Fire Protection in Southern Ontario</u>

The task of protecting woodlands from fire in Southern Ontario presents a very different problem, or rather series of problems, from those of Northern Ontario, and consequently must be handled in a somewhat different manner. Though fire is only a serious question on the Nith Watershed in certain areas such as the Ellice Swamp, it is a question to which some attention should be given.

Northern Ontario is predominantly forest land, the population is sparse, parties travelling through the forested areas are fairly readily accounted for by means of a permit system during the fire season, and watch is maintained for fire by means of look-out towers and air patrol.

In Southern Ontario south of the Laurentian Shield the land is normally potential agricultural land with the woodland surviving in isolated patches as farm woodlots or in larger more or less continuous blocks of swamp or sand up to ten thousand acres in extent. The population is, relatively speaking, fairly dense, no part of any woodland is more than two miles from the nearest human habitation and most roads are travelled by a comparatively large number of people.

In spite of the publicity given to the damage caused by fire the average person does not realize how serious this is. Though he may know that young growth and small trees are burned by surface fires he does not realize the extent of the less obvious damage such as the destruction of humus which itself preserves the condition and water-retaining capacity of the soil. When the humus and ground cover are destroyed the

sun and dry winds remove the moisture required for tree growth and plant nutrients are destroyed. The heat of the fire also injures the growing tissue inside the bark of older trees which are not actually burned, exposing the wood to attack by insects and fungi. Even though through time the wound may be completely healed, the damage shows up as defects when the tree is cut for lumber.

Many farmers in Southern Ontario are so completely ignorant of, or indifferent to, the damaging effects of fire that they deliberately set fire in peat land to burn off the peat, starting fires which it is next to impossible to extinguish. Such fires burn for months, even under the snow, destroying many acres of woodland every year, not only on the land of the person setting the fire but frequently spreading over land adjacent to it.

The first step in fire control is fire prevention, and the best assurance of prevention is an enlightened public opinion which will make every member of the rural community conscious of the seriousness of fire damage and of his duty as a citizen to do all he can to prevent it. The farmer can prevent most fires in farm woodlots if he exercises the same care that he does around his home and building.

Experience in the United States has shown that the most effective fire protective systems in rural districts are those set up under a state organization with local wardens appointed by the state forester on the recommendation of the local town[1] councils. In the rural parts of the State of Maine each town appoints its own fire wardens who handle fire protection in the town quite independently of other towns. This means there is a lack of co-operation between towns, wardens receive little practical training, organization is loose, and as wardens hold office at the pleasure of the town council there is a serious lack of continuity in administration.

In New Hampshire and Vermont wardens are appointed by the state forester on the recommendation of the council and in Vermont they serve until they resign or are removed for

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1. The "town" in the eastern United States corresponds closely

cause by the state forester.

Mr. H. H. Chapman, writing in the Journal of Forestry, states[2]: "It is not unreasonable to conclude that the ratio of 34 to 1 in damage per acre of woodland between these two states (Maine and New Hampshire) is the direct consequence of Maine's failure to depart from the 'fire bucket' principle of town organization".

From the evidence collected in the northern states of the United States, where conditions most nearly approximate those of rural Southern Ontario, it is apparent that the most effective fire protective systems are those set up under the following conditions:

(1) Where the system is organized under the direction and control of the state forester and the wardens in each town are appointed by him on the recommendation of the local council.

(2) Where wardens paid an annual retainer are actual residents in the locality. Usually they are farmers who have had practical instruction in fighting fire. They have the power to call out other local residents to help in fire fighting and maintain a store of fire-fighting tools on their premises.

(3) Where the warden is assisted in his work by all members of the community. That is, his address and telephone number are known to everyone and fires are reported to him immediately.

(4) Where designated members of the community know that they are likely to be called on to fight fire and are paid so much per hour for the time they are so employed.

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2. Journal of Forestry, Vol. 47, No. 2, 1949.

(5) Where every resident is thoroughly fire-conscious and realizes that loss of timber by fire is a loss to the whole community, and considers it his duty to prevent, report and fight fire.

(6) Where fires for burning brush and rubbish may be set only after a permit has been obtained from the local firewarden.

7. Marketing Woodlot Products

Many wood-using industries operate in Southern Ontario. These include sawmills, pulp mills, veneer factories and furniture factories as well as others requiring special products. These industries use large supplies of lumber, most of which is brought in from Northern Ontario and the United States, smaller quantities being purchased from woodland areas throughout the agricultural areas in the Province.. In purchasing these supplies no organized method of marketing is practised which, besides stabilizing prices for such products, could also serve as a clearing house for quantities and types of certain species. Almost everything the farmer sells is aided to some extent by a scheme of marketing, and woodlot products should not be an exception.

As a partial solution to the problem of marketing the products of farm woodlots in Ontario, it is recommended that the following steps be taken immediately:

(1) That all sawmills, both permanent and portable, and irrespective of size, be registered and required to report their daily and annual cuts.

(2) That lists be prepared of all wood-working industries which purchase woodlot products in Southern Ontario, including sawmills, pulp mills and veneer mills as well as agents handling piles, poles, posts and fuelwood; these lists to include the type of material

purchased, whether logs, bolts or pieces and the specifications for the same, including species, size, quality and grades.

(3) That wherever possible current prices of the above-mentioned products be listed. This information is now available to woodlot owners through the District Forest Offices. The subject of marketing is covered in more detail in Chapter dealing with sawmills.

CHAPTER 6

FOREST INSECTS AND DISEASES

1. Forest Insects

In any project, such as proposed for the Nith Watershed, careful consideration should be given to the prevention of insect outbreaks and adequate arrangements made for the immediate application of control measures when these become necessary. While it is not possible to predict accurately the course insects may take under the ever-changing conditions of a newly forested area, there are a number of fundamental principles which, if applied, will greatly lessen their destructiveness.

It is important to avoid the planting of large areas of one kind of tree, otherwise conditions will be ideal for an outbreak of abnormal numbers of some insects which prefer the food afforded by that particular host. It is preferable to plant in blocks, the blocks distributed so that trees of one species are separated by blocks of different tree species. This tends to keep outbreaks localized until natural agencies bring them under control and facilitates direct control measures if such become necessary.

It is important to plant only the species of trees suitable to the site and existing growing conditions. Healthy, vigorous trees are certainly more resistant to insect attack than weak, struggling ones.

Over-mature and dead trees should be removed from the existing stands as these harbour bark-beetles and wood-boring insects, which may become excessively abundant and attack healthy adjacent trees.

Care should be exercised to prevent ground fires Even light ground fires are frequently followed by severe outbreaks of bark beetles and wood-boring insects.

Woodcutting operations, sawmill sites and wood storage yards should be carefully supervised or they may become reservoirs of infestations.

It is essential that surveys for insect conditions be made each year so that any abnormal increase in insect populations may be noted and control operations initiated before they develop to outbreak proportions. Serious and widespread outbreaks are frequently prevented by prompt and well-timed spraying operations over a comparatively small area. It is therefore necessary that spraying equipment be available and that laneways be maintained within the plantations for spraying purposes. Outbreaks of an extensive nature can generally be brought under effective control by strip spraying. In this method, alternate strips of trees in large plantations are sprayed, thus reducing the initial infestation and at the same time causing the native parasites to concentrate and build up in the unsprayed portions. This reduces spraying operations and the number of lanes for the passage of spraying equipment.

Owing to the danger of injury by the white pine weevil, white pine should not be planted in pure stands unless the stands are very densely stocked in a good site. It is better to grow white pine in mixture with some immune species such as the better hardwoods. The protecting species should be taller than the white pine, at least in the early years.

In conclusion, it should be recognized that protection against leaf-feeding insects is very desirable since defoliation of a tree weakens it and thus makes it more susceptible to attack by bark-beetles and wood-boring insects as well as by organisms which do not usually attack healthy trees but which will hasten the death of weakened trees. Leaf-feeding insects alone may kill a thrifty, broad-leaved deciduous tree by completely defoliating it for three years in succession. Conifers, however, are usually killed as a result of one complete defoliation.

2. Tree Diseases

Productive woodlands require protection against fire, trespass, grazing animals and rodents, insects and

disease. Protection is a part of forest management, and under a policy of sustained yield will be maintained in continuity. Good forest management is reflected in the health of the woods and, conversely, damage on account of disease is often a sign of mismanagement or neglect. In general, an objective of maximum yield, with attendant intensive silviculture, is compatible with, and often facilitates, protection and disease control.

For the purpose of discussing their pathology and protection, the hardwoods may be considered separately from pine in natural stands or plantations. The chief diseases of the hardwoods are the various trunk, butt and root rots, and chronic stem cankers, which are all endemic and may cause serious damage under aggravating conditions. Woodlots on the Nith Watershed present very diverse conditions with respect to the incidence of these diseases, a circumstance which is usually related to their past history. Thus many containing old timber are in need of heavy preliminary salvage and sanitation cuttings as a result of mismanagement or neglect. Such cuttings should precede or be combined with cleanings and improvement cuttings, designed to improve the composition and structure of the stands. Having established a sanitary condition, normal care should maintain it and obviate loss on account of decay.

The wood rots are commonly thought of as diseases of mature and over-mature timber, but experience has shown that infection may occur at a very early age. Thus in hardwood sprouts the stem may be infected from the parent stump. In older trees infection is chiefly through wounds, either of the root or trunk, which may be caused by fire, trampling by animals, insects, meteorological agencies, or by carelessness or accident in felling and other woods operations.

Hardwoods are commonly cut selectively and not infrequently in clear fellings. Few foresters will approve the latter system, which is in fact often intended as a liquidation of the property. A system based on yearly selection, or

frequent periodic return to conveniently planned subdivisions, has obvious advantages for small woods, and is well adapted to the control of decay.

For many reasons "cleanings" in the reproduction are desirable, especially where the woods have been heavily cut. While favouring the valuable species, those sprouts which, on account of decay hazard, are of undesirable origin should be eliminated. Such will comprise sprouts from the larger stumps and those from above-ground position.

In harvest cuttings, which should recur at frequent intervals, the permissible volume allotted should include trees in which incipient decay is discovered and so far as possible those which have become a poor risk through injury or other circumstances.

White pine is found in young plantations and in natural stands, almost pure or mixed with hardwoods. From the latter stands it tends to disappear on account of hardwood competition, except on sites which are particularly favourable for its reproduction. The white pine blister rust, which, with the well known shoot weevil, is a principal enemy of the species is a factor contributing towards the elimination of seedlings and young trees.

White pine should be encouraged on those sites which are naturally suited to its reproduction so that fairly compact growth may be secured, thereby facilitating the protection problem. It is an important and valuable species in Southern Ontario, and its cultivation should be promoted by the institution of effective blister rust control facilities.

CHAPTER 7

LAND ACQUISITION

The problem of land acquisition in any part of agricultural Ontario, where practically all the land is privately owned, is one which requires careful approach. The ownership and use of land, especially for agricultural purposes, is considered by most citizens as one of their few remaining inalienable rights. However, where the good of the whole community is under consideration, such personal rights should be, and have been, overruled under the principle of eminent domain. Examples of such cases are the building of highways, the construction of power lines, and the acquiring of land for military purposes in the event of a national emergency.

In Southern Ontario compulsion has not been exercised to any great extent by the Government in planning proper land use schemes. But who would gainsay the fact that the acquiring of poor land on the Nith Watershed for conservation purposes constitutes a national emergency, and therefore requires a more permanent authority than the individual to bring it back to its proper use?

However, in dealing with land acquisition it should not be the desire of any authority to approach the problem in a dictatorial manner. It will require careful handling, and as a preliminary step in such work the people of the area should be acquainted with the purpose of the scheme, its ultimate benefits to the community, and by explanation and demonstration be gradually brought to the point where they will be glad to co-operate.

The only part of the Nith where large-scale transfers of property from private ownership to a forest authority would have to be made is in those areas which are recommended as source areas.

1. Methods of Acquiring Land

There are several ways in which land can be acquired and controlled for conservation purposes, and it is proposed to enumerate and discuss these briefly in this section.

(a) Transfer by Private Sale

The most satisfactory method of acquiring land is by private sale between the Conservation Authority concerned and the landowner. This method has been followed by the counties of Ontario in purchasing land for reforestation work in building up the system of county forests, which totals in round figures 65,000 acres. This method has its drawbacks, however, as individuals who have not the community's welfare at heart, or for one reason or another have an exaggerated idea of the value of their property, may block the completion of a unified area by refusing to sell. This was overcome in the State of New York, which has purchased over 450,000 acres of land for reforestation, by refusing to buy individual parcels of land unless there was a sufficient number in a group to make a contiguous block of 500 acres.

(b) Maximum Price per Acre

Another method which has been used has been to fix a maximum price per acre for this class of land, beyond which the forest authority is prohibited to go, allowance being made for the presence of good fencing and buildings on the properties, which in some cases have been removed by the vendors and allowed as part payment for the land.

(c) Agreements

Where owners of property prefer to retain their woodlots, or where parts of farms fall within the forest area prescribed, and providing the retaining of ownership does not jeopardize the complete conservation scheme, agreements could be made for the control and

management of such areas.

This method has been adopted by the Dominion Forest Service in Nova Scotia, where it has been desirable to control wooded areas for experimental and conservation schemes, and in this particular case the agreements cover a period of twenty years.

In Ontario there is one example, at least, where a municipality leased a part of a farm for reforestation work for fifty years, and one United Counties council has adopted the plan of taking easements on land for the same purpose.

(d) Control by Existing Legislation

Under the authority of the Private Forest Reserves Act (R.S.O. 1950, Chapter 288), the Minister of Lands and Forests, on recommendation to the Lieutenant-Governor in Council, may, with the consent of the owner of any land covered with forest or suitable for reforestation, declare such an area to be a private forest reserve. When such an arrangement is made the Minister or his representative may reforest such areas, supervise the improving and cutting, and prohibit the removal of trees by the owner without his consent, and also prohibit the grazing of the area by cattle.

(e) Life Lease

Many of the farms on the proposed forest, as already mentioned, are of low agricultural worth and are supporting families at the present time. The problem in such cases is not so much the purchase of the property as what will become of the family after the farm is acquired. In almost every case it would be impossible for the vendor to purchase another farm with the money he receives, except one which is of approximately the same value outside the forest. In some cases such farms are occupied by older people whose families have grown up and left the community. The removal of these from their properties might work undue hardship on them, and in fact in some cases they might become a burden

on the municipality. With some of these the plan of giving the vendor a life lease would be sufficient. In most cases such old people make little attempt at farming the whole property, but require only sufficient pasture for a cow or two, enough land for a garden, the house and buildings, and a supply of fuelwood. The plan of giving a life lease has been adopted in the case of two properties,[1] at least, on the county forests in Ontario, and has proved satisfactory to both contracting parties.

(f) Tax Delinquent Land

Under the Statutes of the Province of Ontario,[2] land which becomes tax delinquent is sold by the County Treasurer. In the case of a farm this is not done in practice until the land has been in default for three, or in some cases, four, years. Even then the owner has the privilege of redeeming his property within a year. Where such lands are marginal or submarginal, they are sometimes bought for only a part of the area which is of special value, such as woodland, old buildings, or a good field or two. In some instances the poor land remains idle and frequently appears again at the tax sale. The fact that such land becomes tax delinquent is an indication in many cases that its ultimate use is forestry. Under the present Statutes the municipalities are not permitted, at the first sale at least, to acquire or reserve such land for conservation purposes. Consequently this report recommends that the Authority expropriate all tax delinquent land subject to the regulations of the Municipal Act.

(g) Expropriation

As a last resort in land purchases, or where the owners of abandoned land cannot be located, such areas can be acquired by expropriation. The Conservation Authorities Act, R.S.O. 1950, Chapter 62, Section 15 states:

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1. Northumberland Forest and Angus Forest.
2. The Assessment Act R.S.O. 1950, c. 24, s. 143.

> "For the purpose of carrying out a scheme an authority shall have the power to purchase or acquire and without the consent of the owner enter upon, take and expropriate any land which it may require and sell or otherwise deal with such land or other property."

Also under the Forestry Act (R.S.O. 1950, Chapter 147, Section 13) provision is made for the removal of settlers from lands unsuitable for farming. To quote:

> "Whenever in the opinion of the Minister, it is found that settlement has taken place on lands not suitable for agricultural purposes, and which said lands are required for forestry purposes, the Minister shall have power to make arrangements for the removal of such settlers upon such terms as may be agreed upon."

As a matter of general interest, it should be stated that this Act also provides for the power to close the roads on lands taken over for forestry purposes, the setting apart of lands for settlement, and the removing of settlers from lands unsuitable for farming. It should also include, however, provision for acquiring permanent or community pastures, and pondage areas where these are required, as an integral part of a large conservation project.

2. Cost of Land in the Proposed Nith Forest

It would be impossible to give an accurate figure for the total purchase price of all land in the proposed forest without consulting the owners of the individual parcels. However, as an indication for arriving at the approximate cost, the amounts paid by the several counties and Conservation Authorities of the Province in purchasing land for their forests will serve as a guide.

In the table below a cross-section of land costs for some of the county and Authority forests will be found. Lanark County is not listed as the land for this was not purchased by private sale. Norfolk and Peterborough Counties, which have large acreages in their forests, do not come under the county forest agreement. It should be pointed out, too that the acreage listed under each forest does not, in all cases, represent the total acreage of that forest to

date, but only that part of it which was purchased by private sale. Of the remaining land making up the total acreage on some of the forests, some was tax delinquent and was therefore purchased at a low figure, some was purchased from the Crown at a nominal sum, while of the remainder the particulars regarding area, cost and nature of purchase, have not yet been listed with the Department.

TABLE SHOWING COST OF LAND

PURCHASED FOR FORESTS

of Forest	Owned By	Acres	Cost $	Cost per Acre $
raska	Ganaraska Authority	3,253	22,078.00	6.78
es	Thames Authority	1,705	8,370.17	4.29
s	Simcoe	991	5,639.75	5.69
erin	Dufferin	1,951	7,945.32	7.37
am	Northumberland and Durham	1,074	9,561.00	8.90
	Grey	463	2,896.00	6.25
rie	Simcoe	2,250	13,921.00	6.18
se	Prescott and Russell	14,416	33,188.00	2.30
rick	Leeds and Grenville	1,789	5,367.00	3.00
er Lake	Bruce	3,553	8,234.25	2.32
umberland	Northumberland and Durham	960	5,920.00	6.16
Lake	Simcoe	2,319	14,589.25	6.29
le	Bruce	1,484	4,177.94	2.81
rontio	Simcoe	600	3,300.00	5.50
idge	Ontario	975	9,050.00	9.28
oria	Victoria	1,715	5,061.00	2.95
an	York	1,174	19,516.00	16.62
ls		40,144	178,814.68	4.45

It should be pointed out too that land acquired in the future by the Ganaraska Authority is likely to cost more than the average price per acre of $6.78 because most of the poorest denuded land has now been taken up and the remainder has more woodland and potential woodland which will naturally raise the purchase price. The very low cost of land in the Thames Watershed is explained by the fact that it is mostly burned-over swamp land with a peat soil which is of no economic value at the present time. Actually the average price of $4.29 per acre includes a ditch tax which exists as a lien against part of the property so that the price of the

land itself was closer to $1.00 per acre. However, it is potential forest land having produced black spruce, tamarack and white pine in its original state and is also essential to the water conservation program.

CHAPTER 8

SNOW FENCES

In the climate of Southern Ontario snow drifting may cause much inconvenience and sometimes hardship. Control can be readily effected by means of windbreaks and is dependent on proper placing with reference to lanes of travel and topographic features.

Where space is limited or land valuable lath or board fences are frequently used, but the cost of erection, removal or maintenance of these can be materially reduced by using trees as permanent windbreaks or shelterbelts. One or two rows of trees are usually referred to as a windbreak and more than two rows as a shelterbelt. The latter is preferable if space permits as it gives better and more permanent protection.

The prevailing winds in Southern Ontario are generally from the west so protection is usually required on the west side of north-south roads, on the north-west side of northeast-southwest roads, on the south-west side of northwest-southeast roads and on the north side of east-west roads.

The object of a snow fence is to mechanically reduce wind velocity near the ground in such a manner as to cause a drift to form where it will be least harmful. The reduction in velocity creates two pools of relatively calm air, a small one on the windward side and a much larger one on the leeward side, and it is here that drifts form, leaving the area further to the leeward free of drifts and comparatively free of snow. The deepest part of the calm pool is close to the windbreak; if the windbreak is open at the bottom - that is, composed of trees with few or no branches near the ground - the deepest part will move further to leeward. As winds become stronger both the depth expressed in terms of velocity reduction and the width of the pool on the leeward side will increase and the centre will tend to move

further away from the windbreak.

A single row of trees, unless it is of a dense coniferous type, is seldom dense enough to completely stop winter wind and may create drifts, just as poor placement of windbreaks may accentuate drifting conditions.

A wide belt of trees which will accumulate a large drift of snow on its windward side may be planted right to the edge of the road, the windward edge extending back a distance equal to three or four times the height of the trees and generally at least 100 feet.

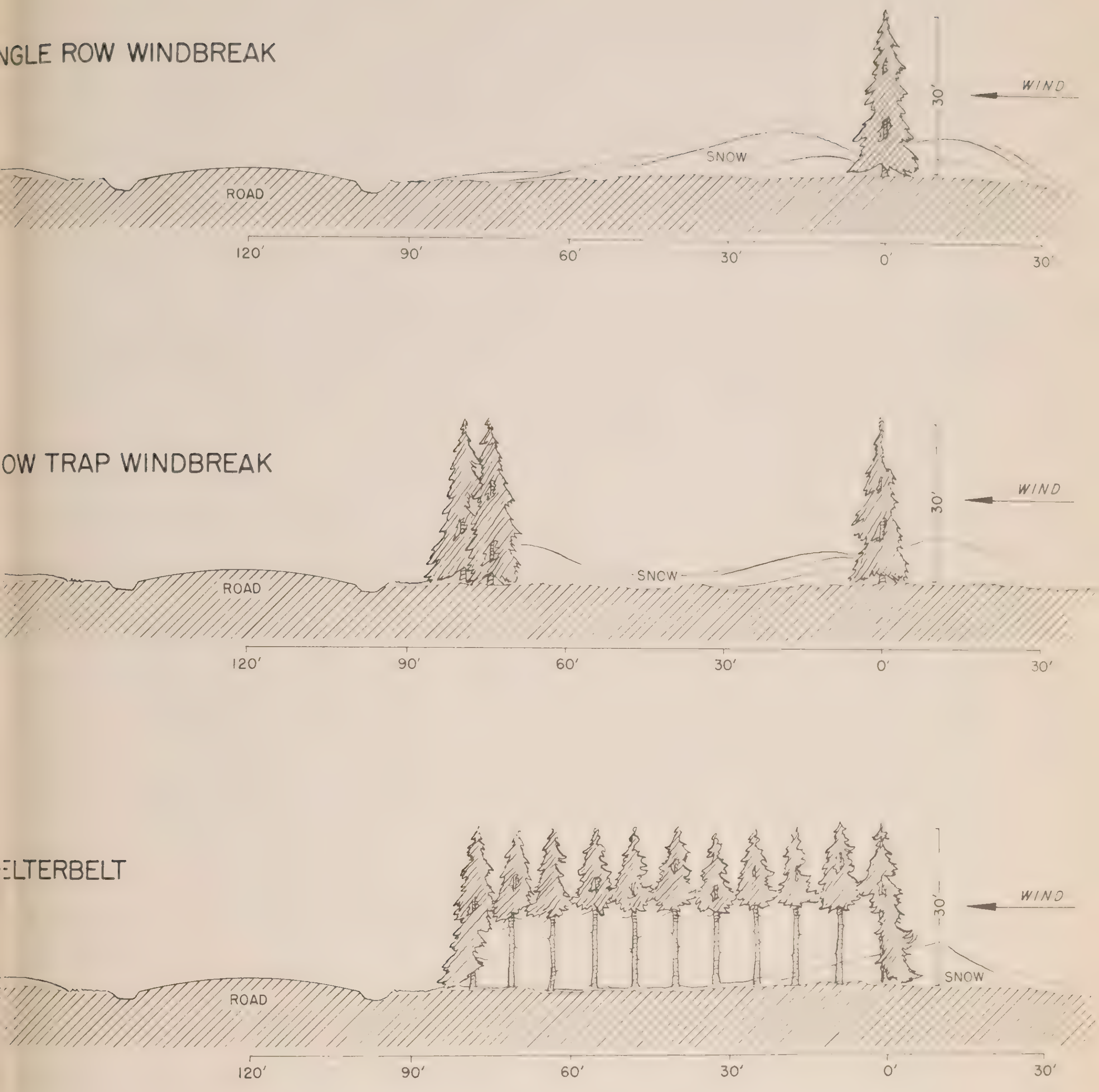
In some places the snow trap type of windbreak is effectively used. It is composed of one or more rows of trees close to the road with a wide opening to windward and then a single row of trees. The single row arrests the first force of the wind and the snow is deposited in the opening. This has the advantage of requiring fewer trees than the shelterbelt and leaving the ground between open for cultivation in summer.

Any prejudice which may exist against windbreaks for protection against drifting snow on roads arises from poor or poorly placed windbreaks. If a windbreak has openings in it or if it ends abruptly streamer drifts will form. Windbreaks should be kept dense and tapered down at the ends by using progressively smaller species of trees and shrubs to prevent the formation of streamer drifts.

Trees are being used successfully as snow fences in Ontario by the Department of Highways, by railways and by a number of counties.

The practice of the Department is to acquire the land by purchase to a width of 100 feet from the centre line of the pavement and plant a three-row windbreak 80 feet from the centre line. The land is ploughed and cultivated and bushy stock about 2 feet high is used. Weeds are kept mowed between the rows and on the open strip between the windbreak and the pavement, which entails a lot of work on

SNOW FENCES



CROSS SECTIONS OF ROAD AND SNOW FENCES

Two methods of preventing drifts at the ends— left end of shelterbelt terminates at a hollow, right end is tapered down to the ground.

the part of maintenance crews in summer. The windbreaks are kept down to a height of 7 feet, partly because many farmers object to their view of the highway being obstructed and also because they are proud of their herds and fields which they want to be visible to passers-by. Also cutting the tops off the trees reduces the temptation, which some persons find irresistible, to cut them for Christmas trees.

County practice varies; sometimes the land is purchased, sometimes it is leased and sometimes it is planted by agreement. In all cases the County erects a fence behind the trees. In return for the use of the land one county plants a three-row windbreak round the farm buildings. Waterloo County has planted an excellent shelterbelt over four miles long on the west side of the county road running north through Linwood. Here the County has acquired a twelve-rod strip (198 feet) and planted the six-rod strip farther from the road, leaving the six-rod strip next to the road to catch the drift while the trees are small. When the trees get bigger it is planned to complete the shelterbelt by planting the six-rod strip next to the road. The trees used are transplant stock about one foot high obtained from the Department of Lands and Forests and planted in furrows. Weeds are kept mowed until the trees are large enough to shade them out.

The species of trees used are Scotch, jack, red and white pine, white and Norway spruce and white and red cedar. The Department of Highways uses both white and red cedar, which it obtains from areas where they are growing naturally, as well as some species usually considered as ornamental stock which it grows in its nurseries. These include mugho pine, barberry and Chinese elm. This last is the only hardwood tree used in windbreaks. It grows rapidly and its fine branching system makes it nearly as effective as an evergreen tree. The other common hardwoods such as Carolina poplar, white elm, silver maple and white ash are used fairly extensively in

Highway Protected by Woodland: The protection afforded the highway by trees is well illustrated here. Note how the stretches of road sheltered by woodlots are clear of snow whereas huge drifts have formed opposite the open fields.

Poorly Placed Windbreak: This windbreak, poorly placed with respect to the highway, has created drifts across the public road.

Waterloo County Shelterbelt — Linwood: A twelve rod strip west of the road has been acquired and the six rod strip farthest from the road planted. The remainder will be planted when the original trees are larger.

Weeds must be mowed for a few years until the trees are large enough to shade them out.

shelterbelts.

Snow fences are usually beneficial to crops in that they hold moisture in the fields in the form of snow in winter and reduce wind velocities and moisture loss by evaporation in summer. Occasionally they do cause ice to form over crops such as fall wheat and may be harmful in this way. The beneficial effects, however, outweigh the harmful ones so considerably that every encouragement should be given to their establishment in place of the removable type of lath fence currently in use.

CHAPTER 9

WINDBREAKS

In the process of clearing land for agriculture, woodlots and belts of trees along fence lines have been removed which had served as natural shelterbelts. The restoration of these in the form of windbreaks is essential to a complete conservation program in many parts of Southern Ontario. Mr. McLoughry[1] in referring to Waterloo County states:

> "Forests and windbreaks of the county have been removed to such an extent, and the organic matter removed to such a degree, that soil drifting has become a serious problem in many areas... The policy we recommend in regard to windbreaks is to encourage the planting of desirable trees."

When proper species are used and windbreaks are correctly placed the effects are almost entirely beneficial. The effects may be direct or indirect, but in either case are the result of reduction in wind velocity. The effects of windbreaks on crops and cultivated fields may be listed as follows:

(a) Direct Effects

(1) Wind damage and lodging in small grains and corn are reduced or eliminated.

(2) Snow and the resultant moisture are more evenly distributed over fields, particularly on the higher spots where they are required most.

(3) Wind erosion of the soil is minimized.

(b) Indirect Effects

(1) Moisture loss by evaporation is reduced.

(2) Temperatures in the fields are raised, which may prevent frost damage, accelerate growth and even lengthen the growing season slightly.

(3) Erosion of the soil by water may be reduced by its more even distribution when released from snow.

The benefits of windbreaks to buildings in reducing heat loss in winter have been shown to be considerable.

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1. E.I. McLoughry (Agricultural Representative). Proper Land Use Program of Waterloo County. 1950.

Experiments conducted in the United States[1] proved that more than twice as much heat is lost from a house, per day or per hour, with a wind of 20 m.p.h. as with one of 5 m.p.h., and a windbreak can easily reduce wind velocities in this proportion. Used in this way they can often be made to form an effective background for the house and home grounds. Another advantage of windbreaks is that they provide shelter and runways for insectivorous birds and small animals.

Belts of trees comprising one or two rows are usually called windbreaks, and with more than two rows, shelterbelts. In Southern Ontario windbreaks as a rule give sufficient protection except where wind erosion of soil on rolling land is severe, when shelterbelts may be required. On level land windbreaks may nearly always be established along existing fence lines, but on rolling land consideration should be given to the contour of the land. The prevailing winds in Southern Ontario are generally from the west, so that the greatest protection will be derived from windbreaks on the west side, but the placement of windbreaks on the other three sides as well should be considered.

Both the height of the trees and the wind velocity influence the effective range of a windbreak. An average windbreak will reduce the ground velocity of a 20-mile wind 10 per cent or more for a distance of about 30 times the height of the trees. About one-fourth of this effect will be felt on the windward side of the windbreak and three-fourths on the leeward side. For example, if the trees are 40 feet high the total effective range with a 20-mile wind will be 30 x 40 or 1,200 feet, 300 feet of which will be on the windward side and 900 feet on the leeward side. Generally speaking, the reduction in velocity is greatest close to the windbreak and tapers out to zero further away.

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1. Windbreaks as a Farm Asset. U.S.D.A. Bulletin 1405.

A windbreak which has effectively eliminated wind erosion on light land.

Crop shows little loss in size or vigour when planted close to European alder.

This is not the prairie but a windswept, treeless stretch of Perth County.

Contrast this farm home with the house above. The windbreak gives protection, comfort and stability.

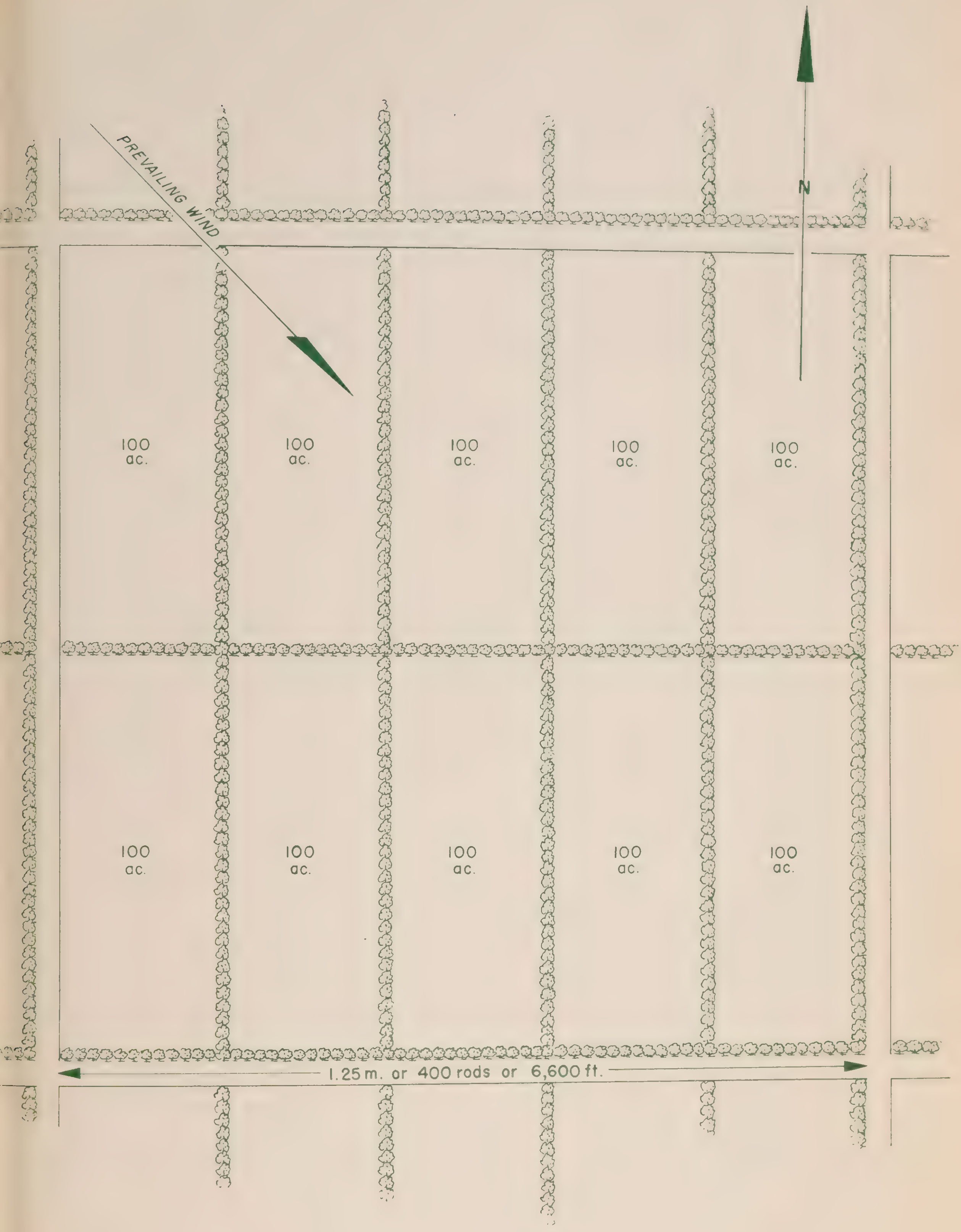
With higher wind velocities and/or higher trees the proportionate reduction and the effective range will be greater.

A windbreak not only reduces the velocity of wind striking it but also slightly increases the velocity of the wind diverted over, round or through it if there are gaps. The increase in velocity of winds passing over it increases its effectiveness somewhat but the increase in velocity of winds passing round or through it will increase the damage caused. For example, snow drifts will form at these points (see chapter on Snow Fences).

On level land in Southern Ontario windbreaks completely surrounding each farm of 100 acres would normally give adequate protection except for light rolling land and such wind-sensitive crops as tobacco. These should be on the west side of north-south roads, but on east-west roads would have to be carefully placed on the north or south sides, depending on the direction of the local prevailing winds. On land which is not level at least the same proportion of windbreak to area should be provided, but in many cases this would have to be adjusted according to the local topography. That is, the trees should be planted on suitable contours and where hilltops or slopes are eroding badly it will be necessary to establish plantations over a large part of the eroding area. The windbreaks should, of course, be tied in with plantations and existing woodland so that where these exist additional protection would not be required.

Since density, both in winter and summer, is one of the prime requisites of a good windbreak, the conifers in most instances make the best windbreaks. The slower-growing species such as white cedar and spruce give most protection but the faster-growing ones such as the pines have the advantage of attaining more effective heights in a shorter time. A number of broad-leaved trees have fine, dense branching habits and may be nearly as effective as conifers if the branches are maintained down to the ground; among these may

WINDBREAK PLAN
for
1,000 ACRE BLOCK



This plan shows the minimum windbreak requirements for a 1,000 acre block on level land. Woodlots and plantations will replace some of this and placement will have to be adjusted according to topography and soil on rolling land.

be included sugar maple, Chinese elm and European alder.

European alder is gaining great popularity as a windbreak tree because it is a nitrogen-fixer like the legumes and does not rob the soil to the same extent as non-nitrogen-fixing species. In fact, tobacco is frequently planted close to it with little loss in size or vigour of the plants. As the robbing of the soil is one of the severest criticisms levelled against windbreaks, consideration should also be given to the planting of such leguminous trees as honey locust and caragana on certain sites.

One consideration that should be kept in mind is that under certain circumstances windbreaks may cause air stagnation, which may increase temperature and moisture conditions to a dangerous degree in summer or increase frost damage in spring and fall on small areas, particularly in hollows. Where this is likely to occur, windbreaks should be planted so as to guide the flow of air past such spots. Where these conditions develop after the windbreaks are established they may be relieved by judicious opening up of the windbreaks.

Experience has shown that windbreaks are an asset to any farm, that their adverse effects, if any, are local and easily remedied, and that in many areas they are essential to the control of soil erosion by wind. It is therefore recommended that the Authority encourage the establishment of windbreaks by private owners in every way, and the purchase of a tree-planting machine which could be rented out for this purpose should be considered.

CHAPTER 10

SAWMILLS

For many years the forests which originally covered most of Southern Ontario were a hindrance to the progress of agriculture. The forest was burned and slashed to clear the land for crops and, with only a small portion of the timber cut being utilized, the revenue realization from this measure was small. Later the manufacture of lumber and other forest products became an important industry. Exploitation of the forest capital rather than harvest of a crop became the prime motive. This sequence of attack on the forest brought about rapid depletion of the virgin timber.

The dwindling forest resources suffered further as available merchantable timber was liquidated from time to time to bolster set-backs in agriculture. In time of need the farmer derived income through woodland sale.

This process of woodland depletion went on without consideration of forestry as an integral part of the farm business. Yet perhaps the most promising means of supplementing farm income to maintain a satisfactory level of living in many rural communities is the husbanding of the forest resources and the development of a permanent woodland enterprise. Many farmers strive for high yield per acre or per animal in agricultural enterprises, but few give comparable attention to the productivity of their woodland.

As forest depletion became more acute, there was a rapid decline in forest industries. Now the forest plays only a minor part in rural economy. Satisfactory processing facilities are no longer available in many sections to provide adequate outlets for farm forest products.

When the farm woodlot is managed according to good forestry practices and the annual wood growth of a

given area removed annually or periodically in trees of appropriate size, instead of treating the entire woodlot as a crop and more or less clear-cutting once in a minimum of sixty to eighty years, then the woodlot should provide, in the majority of cases, a periodic cash return to the farmer from log and fuelwood sale. This selective logging then, involving annual cutting equivalent to the annual increase in volume, offers to the log market small numbers of logs of different species and all grades from the individual farm woodlot, with greater numbers of logs from the larger woodlots.

The profitability of the woodland enterprise depends on the availability of adequate marketing facilities. The primary users of woodland products such as sawmills, veneer mills and others are not the only markets, but all the industry that depends on the primary plants for its raw product, whether purchased directly from the plants or through the intermediate handlers or processors. Thus a study of the farm woodlot marketing problem should follow the woodland product from the tree on the stump through to its ultimate consumption, whether in the manufacture of furniture, wooden heels, veneer or plywood, farm implements or many other products of the wood-using industries including lumber for construction.

For this reason a study was made of the present log market to determine how it functions, the markets for its products, and the sources of wood for the local wood-using industries. Within the entire Nith Watershed the total annual consumption and number of establishments manufacturing products from wood is small in comparison with that of individual cities just beyond the Nith Watershed boundary. Because of this the area studied was extended beyond the Nith Watershed boundary four to five miles on the average to obtain the picture of raw product supply to the nearby large centres of wood-using industries - manufacturing

chiefly furniture - such as Kitchener, Waterloo, Preston, Listowel and Stratford. The area studied is shown on the accompanying map.

In this report the term "hardwood" is used to denote all broad-leaved trees irrespective of whether the wood is physically hard or not. This practice is followed by large firms which handle both hardwoods and softwoods. At the smaller sawmills and lumberyards and among farmers it is a common technical misnomer to term as softwoods the hardwoods which have physically soft wood such as poplar, basswood, white (swamp or soft) elm, willow, and sometimes soft (red and silver) maple. For example, a sawmill with stove-length slabs for fuelwood offers -

softwood - white pine, <u>white elm</u>, hemlock, <u>basswood</u> and <u>poplar</u> at $11 per standard cord delivered

hardwood - white ash, beech, cherry, oak and the maples at $15 per standard cord delivered.

In the above case three broad-leaved species which have wood of soft texture are termed "softwood".

Since the forest growth and logging industry in the area is dominantly hardwood, the discussion throughout this chapter is chiefly relative to hardwoods.

1. <u>Local Wood-Using Industries</u>

The sale of sawlog material from the woodlot depends on the mill-operator having sale for the lumber he manufactures. The following study of local wood-using industries shows their sources of wood and thus their dependence on supply from local woodlands.

There are no natural boundaries in the field of manufacturing from wood at which divisions can be made for study. For this report it was intended that industries whose products are ordinarily thought of as being made of wood would be termed the wood-using industries. By this limitation some manufacturings which consume large quantities of wood were not visited. An example of this in the area is a large well known luggage manufacturing plant in Kitchener.

In the area 88 establishments qualified as wood-using industries or intermediate handlers of wood products. For convenience these were broken down into three general divisions as follows:

(a) Wooden furniture and allied field (31 establishments);

(b) Lumber merchandising, millworking and allied field (45 establishments);

(c) Miscellaneous wood manufacturings (15 establishments).

These divisions were assigned as a simple pattern to fit the field examples encountered. Overlapping between divisions seems unavoidable. However, only three establishments have dual categories under this divisioning; for example, one furniture plant also manufactures children's playthings and so is noted in both the first and third divisions. Thus the apparent total number of establishments visited increases by 3 to 91. (See accompanying map for location.)

The phases of the lumber and products industry met and sources of the raw products are outlined for the three divisions.

(a) Wooden Furniture and Allied Field

Each of the 31 establishments in this division can be assigned to one or more of the following phases of furniture manufacture.

(1) Breaking out of furniture components from blanks as semi-machined or precision-machined parts or corestock; sub-assemblies may be made.

(2) Wood-turning plants selling their labour and expert technique to furniture plants; doing precision turning of blanks or semi-machined components.

(3) Manufacturing ornamental wood-moulding and trim primarily for the furniture industry.

(4) Manufacturing furniture frames and unfinished furniture, or making furniture from broken-out stock purchased from a plant in the first category above.

(5) Manufacturing home appliances in part or entirely such as ice refrigerators, radio and television cabinets, kitchen cupboard

and sink assemblies.

(6) Manufacturing wooden furniture complete in every respect; furniture for home, office, school, hospital, theatre, hotel, etc.

The majority of establishments manufacturing wooden furniture carry on, more or less, the complete manufacture of furniture from rough lumber. Over 60 per cent of these are in Kitchener and Waterloo.

These manufacturings utilize hardwoods almost exclusively; softwoods are used extensively for crating the manufactured products. Carload purchase of graded, air-dried lumber is the rule; however, local and regional purchases are general, and in smaller lots, by force of circumstances and the transportation is most commonly by truck.

The chief Canadian hardwood lumbers used are yellow and white birch, hard and soft maple, basswood, white elm and white ash; others used in lesser quantities are poplar, rock elm, black cherry, oak and beech.

The chief imported lumbers used are white and red oak, walnut and mahoganies; others used in lesser quantities are gum, chestnut, red cedar, willow, sycamore, poplar and white ash. Another imported "wood" is the monocotyledon, rattan.

Large quantities of American oak are used. It is preferred over native oak because it is a well-graded, generally bandsawn oak of good quality for furniture. It is uniform in colour and soft-textured and may be obtained in large quantities with ease. The chief source is West Virginia and Kentucky and the oak is referred to as Appalachian oak. When a harder oak is desired it is obtained from south of this region. This prejudice against native oak seems to have a complete following throughout the industry.

The Canadian hardwoods are obtained from Northern and Southern Ontario, Quebec and the Maritimes.

In view of the total consumption of the industry in the area (Kitchener and Waterloo alone consume more than 7¼ million board feet of hardwoods annually - 25 per cent more than is produced by the 28 sawmills in the area), only a small percentage is of local or regional origin. However, from the viewpoint of the local sawmilling industry, its best customers are the furniture and other special industries.

The furniture industry is quite exacting in its demands for specific lumber grades; it is to a large degree prepared to buy locally and avoid freight rates where it can be assured of a well-graded product. Efficient grading is a shortcoming of the local sawmilling industry and, when carried out by a mill of relatively small annual production, the various grades become separated in rather small volumes; this necessitates considerable "shopping" by a consumer in order to obtain a good quantity of a given grade. Inefficient grading and sporadic supply discriminate against the regional lumber manufacturers; however, the consumer may reduce the grade risk in such purchasing by personal visits to the mill when it is located nearby. The establishment of mutual goodwill between the small lumber manufacturer in Southern Ontario and the wholesale consumer, rather than reliance on rigid grading, is a major factor in consumer pruchasing.

Individual manufacturers may rely chiefly on Southern Ontario supply for some species such as elm, maple and beech, but the predominance of Ontario supply is from the north. A small percentage of the industry backs sawmilling financially or owns mills outright in areas of more extensive hardwood coverage such as Haliburton. The majority of the industry purchase direct from mills anywhere in Canada rather than from wholesalers.

Large quantities of plywoods and veneers are used. They are obtained locally through wholesalers or

direct from the manufacturers. Northern Ontario and Quebec spruce is the chief crating lumber used. Low-grade lumber for crating forms a startling percentage of the total consumption by individual manufacturers; but there is a definite trend towards use of corrugated cardboard boxes, excelsior pads and heavy paper for this purpose rather than lumber.

(b) Lumber Merchandising, Millworking and Allied Field

Each of the 45 establishments in this division belongs in one or more of the following general categories.

(1) Lumberyards - retail and wholesale - may do millworking to varying degrees; some have an associated construction business; most handle the general builders' supplies.

(2) Millworking plants - primarily planing, matching and moulding; may be purely custom or may manufacture and stock their products.

(3) Plywood and veneer wholesale establishments.

(4) Miscellaneous general woodworking and custom wood-turning plants.

Lumberyards market chiefly to the construction field; thus their turnover is mainly softwoods (90 per cent). Over nine-tenths of the hardwood handled is flooring and is imported oak, yellow and white birch, and hard maple. Thus the volume of local hardwoods handled is very small. Over 95 per cent of general yard stock is "imported" from Northern Ontario, Quebec, British Columbia, and the Maritimes and Alberta to a smaller extent. Local hardwood lumber manufacturers must compete against the goodwill established by merchandisers in their purchases of softwoods from outside points which in many cases offer well-graded hardwood lumber too.

Millworking establishments manufacture large quantities of chiefly the "imported" softwoods into sash, door, interior trim, frame, all types of siding, and other products. Chief species used are eastern and western pine, spruce and hemlock; western cedar and Douglas fir. Lesser quantities of local or "imported" hardwoods are used for stair treads, door sills, interior trim, and so on.

Plywood wholesalers handle chiefly birch, Douglas fir and basswood plywoods obtained from Ontario, Quebec and British Columbia manufacturers. Lumber and veneer importers handle "woods of value" such as walnut, mahoganies, southern cedars, gum, cypress, etc., and fancy face-veneers such as walnut, mahogany and oriental species.

Small establishments doing miscellaneous general woodworking, mainly farm equipment repair and custom equipment work, use local hardwoods and softwoods chiefly.

(c) Miscellaneous Wood Manufacturings

The 15 establishments in this division represent 10 different types of manufacturing.

Product Manufactured	No. of Plants	Raw Material and Source
Playthings and sporting equipment	4	Hardwoods - local, regional and "imported"
Tight cooperage and wooden tanks	1	Hardwoods and softwoods - "imported" and American
Basket bottoms	1	Hardwoods - waste cores of a local veneer plant
Industrial trucks (platform)	2	Hardwoods - local, regional and "imported"
Shoe-last blocks and finished shoe-lasts	2	Hard maple exclusively - local
Wooden heels	1	Hardwoods - local and regional.
Veneer	1	Hardwoods - local and world-wide.
Caskets	1	Hardwoods and softwoods - "imported"
Brush blocks and broom handles	1	Hardwoods - local
Box shooks, wooden boxes and crates	1	Softwoods - "imported"

This group consumes chiefly hardwoods, a considerable volume of which is local supply. Three of these plants are engaged in manufacturing their specialty complete from the raw log stage. These are:

Pannill Veneer Company of Kitchener - purchases local hard maple and basswood veneer logs (logs, butts, and crotches);

P. Steffen and Son of Kitchener - purchases hard and soft maple and elm for brush block and broom handle manufacture;

E. Moore of Galt - purchases high-grade hard maple logs for shoe-last block manufacture.

2. Sawmilling in the Area

Twenty-eight sawmills were operating in the area at the time of the survey. Two other mills were under construction - one a portable mill and the other a farmer-operated permanent mill. At least one of these mills has since begun production.

On the basis of figures supplied by the operators the 28 mills in operation annually produce about $7\frac{3}{4}$ million board feet of lumber. Of this about 15 per cent is custom sawing and the remainder is termed "other sawing".

Sawmilling data in this report pertains to mills more or less permanently located in the area studied. The $7\frac{3}{4}$ million board feet is the quantity produced by the 28 mills; it does not represent the annual volume of logging within the area of study. The reasons for this are straightforward. Logs are hauled to these mills from outside the survey area and trucks haul logs out of the area to other mills. (For example, from one cutting operation near the centre of the area logs were being hauled to a mill located at Goderich more than 70 miles away.) Also only one portable mill was encountered in the area; however, portable mills move freely into the area to carry on operations and thus their proportion of the total log-processing is not in the summary figures.

There are no growth rate, yield or inventory data available for Southern Ontario woodlots. It would be useful to determine whether the current annual cutting rate is in excess of annual growth. Logging operators state that the sawlog yield from hardwood stands containing overmature, mature and immature trees is generally between 6,000 and 11,000 board feet (log

SAW MILLS
AND
WOOD USING INDUSTRIES
SAW MILLS
Annual production in thousands of board feet
75 OR LESS (16 Mills)
BETWEEN 75 AND 500 (5 Mills)
500 OR MORE (7 Mills)
WOOD WORKING PLANTS AND LUMBER YARDS
LUMBER MERCHANDISING, MILLING AND ALLIED FIELDS (45 Establishments)
WOODEN FURNITURE AND ALLIED FIELDS (31 Establishments)
MISCELLANEOUS WOOD PRODUCTS (15 Establishments)
(-2 Figure after symbol indicates number of establishments)
SCALE - MILES
1 0 1 2 3 4 5 6 7
DRAYTON
LISTOWEL
MILVERTON
Mill under construction
ST. CLEMENTS
WATERLOO
KITCHENER
PRESTON
GALT
BADEN
STRATFORD
NEW HAMBURG
NEW DUNDEE
TAVISTOCK
AYR
PARIS
LIMIT OF SURVEY
WATERSHED BOUNDARY
NITH RIVER
Smith Creek
GRAND RIVER

scale - Doyle Rule) per acre. Yields of 9,000 and 10,000 board feet are not uncommon. On this basis the annual cut of the 28 mills studied is approximately the yield from 1,000 acres of unmanaged woodland.

3. Location of Mills

The following is a list of the sawmills in the area surveyed; also see accompanying map.

Name of Firm or Owner of Mill	Township	Location
G. Brittain	Blenheim	Lot 20, Con. I
J. Piggott	Blenheim	Lot 22, Con. III
J. Summerhayes	Blenheim	Lot 6, Con. IV
G. Bonney	Burford	Lot 7, Con. III
J. R. Simpson	Dumfries N.	Lot 12, Con. XI
J. Reid	Dumfries N.	Ayr
J. Smith	Dumfries S.	Glen Morris
S. G. Perriman	Dumfries S.	Lot 30, Con. V
P. Braund & G. Laird	Dumfries S.	Lot 34, Con. I
F. Main	Dumfries S.	St. George
D. Gerber	Easthope N.	Nithburg
H. L. Wettlaufer	Easthope N.	Amulree
M. Schmidt	Easthope S.	Shakespeare
A. Malcom	Elma	Listowel
Litt & Brown	Maryborough	Drayton
J. J. Baseler	Maryborough	Lot 12, Con. I
F. Keeso	Wallace	Listowel
J. H. Keeso	Wallace	Listowel
A. Leffler	Waterloo	Lot 44, B.U.B.
F. & P. Lumber Co.	Waterloo	Kitchener
S. G. Baranski	Waterloo	Lot 49, G.C.T.
P. Steffen & Son	Waterloo	Kitchener
N. O. Hipel Ltd.	Waterloo	Preston
A. R. Thiele	Wellesley	Lot 5, Con. III
T. Wilford	Wellesley	Crosshill
H. E. Ratz & Co. Ltd.	Wellesley	St. Clements
T. Lautenschlager	Wilmot	Lot 3, Con. SSR
C. Hamacher	Wilmot	Lot 19, Con. III
R. Musselman	Wilmot	Mannheim
R. C. Hallman	Wilmot	Lot 5, Con. I

Townships of Ellice, Downie, Peel, Woolwich and Zorra East - no sawmills within the area surveyed.

4. Types of Mills - Portable or Permanent

> "Owing to the development of excellent highways and roads and the improvement in efficiency and lessening in cost of operation of logging trucks, the tendency is toward more stationary and permanent location of mills. It is usually cheaper to move logs from the woods to the sawmill even 80 miles or more, if they are high quality logs, than it is to move the sawmill to the forest."[1]

The preceding statement is emphatically substantiated by conditions found in the area studied.

Within the small mill class are permanent and portable mills. The majority of mills studied are second-hand and in earlier days were used as portable mills. They are now rarely moved and are in permanent locations, generally on the owner's property, for the number of years that he remains interested in sawing. This is especially true of farmer-operated mills.

Manufacturers of portable mills have incorporated in them certain features of construction, generally limiting the efficiency of the unit, that might distinguish them from permanent mills and their equipment. The mills visited were categorized, not on the manufacturer's category or on past history, but on the current policy of the owner as to whether he operates the unit as a portable mill. On this basis, formerly over 60 per cent of the mills in the area were used as portable mills, whereas now about 90 per cent can be considered as permanent mills.

The tendency toward more stationary location of mills rather than numerous truly portable mills reduces the threat to woodlots. The threat now exists in the form of motor transport of logs, the flexibility of which can be more readily directed to favour woodlot improvement by selective logging.

5. Reasons for Frequency of Small Sawmills

Beginning with mill efficiency sufficient to give reasonable volume output, sawmilling evolved along the following pattern:

(1) Large permanent mills, water- or steam-powered; steam power was provided by more or less stationary steam boilers. To the mill operators supply of raw material appeared unlimited.

1. Lumber. Nelson G. Brown. 1947.

(2) The development of portable steam-power units brought about the introduction of portable sawmills.

(3) Large permanent mills became less profitable to operate with more scattered areas of raw material to draw on and against competition of portable steam units moving directly to the source of logs.

Fires in the case of steam-powered mills and floods in the case of water-powered mills also took their toll of the permanent mills. The apparent overall situation offered little encouragement to rebuild damaged mills. With disappearance of these mills many farmers lost a convenient source of lumber for their miscellaneous needs.

(4) Around the turn of the century to 1910 or later, portable mills operated by professional operators carried on large-scale logging in the area of the then more extensive woodlots. After a time the lumbering opportunities became less, and for this or other reasons many of the mills became idle.

Consequent to the above order of events, sawmilling has become chiefly a matter of many of the portable mills becoming located on a more or less permanent basis and owned by farmer operators. Some of the early mills continue to operate. Gradual transition has given a sharply different situation in sawmilling from that of some decades ago. At that time more large permanent mills were in operation; more portable mills were operated by professional lumbermen. And in either case the annual output of individual mills was greater than is currently the case.

Reasons for the establishment of small production mills, chiefly the farmer-operated type but also lumberman-operated, are summarized as follows.

(a) Minor capital outlay

Availability and cheapness of mills. Old second-hand portable mills are readily available. Some mills are rebuilt from old mills abandoned in junk heaps. Manufacturers offer new portable mills at relatively low prices.

(b) Suitability of small mills to the present situation

The conditions referred to are those of sporadic and light supply to the mill due to the scattered nature of the small tracts of second-growth timber and also due to the

A farmer-operated mill operated on a part-time basis. The annual production is small and about 80 percent of it is custom work. The mill was formerly a portable unit which was later abandoned.

A large permanent mill of earlier times, now abandoned. Modern truck transport of logs and depletion of available raw product forced its abandonment.

attitude of woodlot owners to logging their woodlots. This attitude varies from complete apathy through all stages of mis-management to, in some cases, a good attempt at commonsense principles of sustained yield.

(c) Availability of power for mills

The commonplace, versatile farm tractor provides power. Since in most cases it is already a piece of the farm equipment, there need be no initial outlay for a power unit, as was the case when mills were powered by expensive portable steam units which also had high maintenance and labour-operating cost in addition to creating an extreme fire hazard. Another ready power source now is by conversion of old truck and car motors to sawmilling service. About 65 per cent of the 30 mills visited are powered by internal-combustion engines and 37 per cent of these are tractor-type power units.

(d) Farmer and other local needs for lumber and timber

Farm building and equipment repair and occasional new buildings provide seasonal and emergency sawing for a small mill working chiefly on a custom basis. Since the mill does not have to provide against high overhead or expensive labour nor retire a large capital outlay, the probability of very extended periods of idleness is of little consequence to its owner; in fact it is generally planned that these fit in with other seasonal work.

Attractive lumber prices start many small mills; business depressions put many out of business.

6. Mill Output

(a) Daily Output

Daily output per mill varies from 1,000 to 10,000 board feet, with the daily sawing rate for the majority of mills apparently between 3,000 and 5,000 board feet. American studies (Nelson C. Brown - Lumber) indicate that the output of small mills seems to vary directly as the number of men working at the mill, being about 1,000 board feet per day per man working - a predominance of hardwoods lowering this figure somewhat. Data from this survey substantiates Brown's finding.

RELATION OF TOTAL ANNUAL AND CUSTOM OUTPUT (28 MILLS)

Annual Output in Board Feet			Custom Per Cent of Total Annual Output
Mill No.	Total Output	Custom Output	
1	10,000	7,000	70
2	15,000	15,000	100
3	20,000	16,000	80
4	20,000	15,000	75
5	25,000	25,000	100
6	30,000	30,000	100
7	40,000	none	(own manufacturing business)
8	40,000	none	-
9	40,000	none	-
10	40,000	36,000	90
11	43,000	38,700	97
12	50,000	45,000	90
13	50,000	40,000	80
14	50,000	50,000	100
15	50,000	25,000	50
16	75,000	30,000	40
Total of Mills 1 - 16	598,000	372,700	62
17	100,000	100,000	100
18	175,000	175,000	100
19	250,000	100,000	40
20	300,000	none	(utilizes waste core of local veneer plant)
21	300,000	none	-
22	500,000	none	-
23	500,000	100,000	20
24	850,000	170,000	20
25	873,000	95,000	11
26	1,000,000	30,000	3
27	1,000,000	none	(own manufacturing business)
28	1,300,000	20,000	2
Total of Mills 17 - 28	7,148,000	790,000	11
Total of All Mills	7,746,000	1,162,700	15

In the above table and in other tables in this report the order of listing the mills bears no relation to the mill location list on page 80, where the mills are listed by townships for convenience.

(b) Annual Output and Custom Output

The largest total output among the mills visited is just over $1\frac{1}{4}$ million board feet per year. The 28 mills in operation in the area annually saw about 7,746,000 board feet of lumber of which 15 per cent is custom sawing. The accompanying table places the mills in order by total annual production; percentage custom sawing of total annual output is shown.

In general as the annual output becomes greater the custom per cent decreases. Sixteen, or 57 per cent, of the mills studied saw yearly 75,000 board feet or less. These mills do less than 8 per cent of all the sawing, spend 62 per cent of the time on custom logs and do 32 per cent of the total custom work in the area. Mills sawing more than 75,000 board feet annually spend 11 per cent of the time on custom logs. The 3 largest mills do 42 per cent of all the sawing and only $1\frac{1}{2}$ per cent of their output is custom.

7. Custom Sawing Rates

The general practice is that charges are made at a set rate per 1,000 board feet mill run - the rate being common to all species. Some mills charge at a straight hourly rate covering the time of log handling in the yard, sawing, piling and mill stoppage due to staples, tapping spiles or other metal pieces embedded in the logs. Unless otherwise understood the slabs and other waste which accrues from the sawing belong to the mill operator.

The custom rates of the following mills give a sample pattern progressing from north to south over the area surveyed. These rates were in effect in the fall of 1949; information on one mill shows an increase of more than 30 per cent in its rates for the 1950 and 1951 season.

Mill No.	Custom Sawing Rate
1	\$ 9.00 per hour
2	\$10.00 per M bd. ft. or \$3.00 per hour
3	\$ 8.00 per hour
4	\$12.00 per M bd. ft.
5	\$13.00 per M bd. ft.
6	\$ 5.50 per hour
7	\$15.00 per M bd. ft. for standard yardstock

Mill No.	Custom Sawing Rate
	A sliding charge scale for timbers according to lineal footage; being 8¢ per foot for logs up to 20 ft. long, 11¢ per foot for logs 20 - 30 ft. long, and 18¢ per foot or $15.00 per hour for logs more than 30 ft. long.
8	$15.00 per M bd. ft.
9	$10.00 per M bd. ft.

Small mill-owners who are doing chiefly custom work state that custom sawmilling is not profitable but they undertake it as a service to the community and a convenience for their own lumber needs. Large mills definitely discourage custom work. This attitude appears to be justified; cost-accounting records of one of the larger mills show it to be unprofitable. In fact it pays only for the direct labour involved and other overhead must be absorbed by the company. This situation arises from the extra labour involved in trying to saw from a given log the sizes of product as specified by the customer and in separate piling for each customer. Thus mills with relatively large output and yard storage space at a premium cannot do custom work profitably.

When a woodlot owner needs a quantity of lumber for a new building or repair of farm buildings or equipment he takes whatever logs he can to the mill. Often the value of the species and of the grades that could be sawn from the logs is far above that warranted by the use to which the material is put. He would be well advised to take credit for his logs and let the mill operator supply him with species and grades best suited to his requirement. The mill owner should supply these at preferred prices, since often he would profit by being able to dispose of his poor grades of low market value which he has on hand and in return receive a quantity of better grade material which can be diverted to more economical use. It is not uncommon that owners of small mills barter various services for logs.

This mill producing over a million board feet annually is operated by a professional lumberman on a full-time basis. Custom output is only about one per cent of the total.

A portable mill under construction.

8. Species Sawn

The chief softwood species sawn are white pine and hemlock. Occasionally white cedar is sawn. Balsam fir is sawn in small quantity in the north end of the area and is also taken from the swamps of Black River in Blenheim Township.

Approximately 20 per cent of all sawing in the area is softwood. Generally, for all mills, as the annual output category is greater the softwood per cent sawn is less. This is a reflection of the availability of merchantable softwoods and of the tendency of farmers to have sawn softwoods rather than hardwoods at the smaller, chiefly custom-sawing, mills. Cutting pressure on local softwoods is far more severe than on local hardwoods.

The leading hardwood species sawn are hard maple and white elm; other species are beech, red and white oak, basswood, white ash, soft maple, and poplar. Occasionally yellow birch, black cherry and others are sawn.

9. Log Transportation and Log Source Distance

Truck hauling far exceeds any other method of log transportation; much of this is by special logging trucks. The improvement of log transportation by truck over improved roads has put the portable mill on a basis of permanent location; it could aid farm woodlot management on a large scale. The motor truck can be utilized to provide great latitude and flexibility in picking up logs in the open market from skids located along the improved roads.

General haul distances and maximum haul distances present the picture of log source in an essentially agricultural area. The general haul distances obtained for 22 mills average 10 miles, while their maximum haul distances average 22 miles. The 3 mills of largest annual production report the longest general and maximum hauls as follows:

Mill No.	Annual Output (bd. ft.)	Haul Distance (miles) General	Haul Distance (miles) Maximum
1	1,000,000	15	30
2	1,000,000	35	75
3	1,300,000	30	75

The study indicated the general maximum haul distance of logs for lumber to be 75 miles; but logs for specialty purposes may be hauled much greater distances. An example encountered of the latter was hauling hard maple logs for shoe-last blocks 125 miles.

10. Log Purchase Methods

There are two distinct sources of raw material from the viewpoint of the sawmill operator. These are (1) timber land, owned outright by the operator, or on which he has cutting rights by contract, and (2) open log-market purchases. However, it is rather common for the mill-owner to purchase a few selected standing trees in a woodlot at a stumpage rate or an outright lump sum, or offer a delivered-in-the-yard rate for the logs.

The majority of mills visited obtain raw material chiefly by purchase in the open market. The logs are bought in skids or delivered in the yard with a fair price differential to cover hauling costs. A few mill-operators derive sufficient supply from the woodlots on their own farms. In general, only the largest mills practise buying entire woodlots for logging. This represents the largest volume source of logs in the total for all mills visited. Often these owners buy whole farms in order to acquire the woodlot, then resell while retaining cutting rights in the woodlot for a given number of years. Some mill-owners purchase woodlots on an acreage basis; one operator reported paying about $100 per acre for swamp woodland - chiefly hardwoods.

The method of purchase of entire woodlots generally involves an estimate by the prospective buyer, according to his own methods, of the probable output of the stand. He

then offers payment on this basis on whatever terms are agreeable to both parties. Agreements are widely variable; "deals" are made in any way possible. Undoubtedly many of these "deal are designed to take full advantage of the present income tax law which treats revenue from selective logging as income and therefore taxable, while clear-cutting revenues constitute capital gain and therefore are not taxable. Unfortunately, as long as the tax law has its present interpretation the vicious practice of clear-cutting instead of increment cropping is favoured.

The availability of woodlots for purchase is a matter of prime interest. According to two mill-owners, whose families have long been resident operators in the area, woodlots become available chiefly when a farm changes hands due to retirement or death of the owner and when there is no immediate family who will carry on the farm. Due to this, in the words of one operator, "we have a crack at a good bush every year".

The purchasing of entire farms for the purpose of cashing in their woodlots is practised probably as much as lump sum or stumpage purchasing of individual woodlots. Generally in these cases the farm is re-offered for sale but cutting rights are retained. If re-sale is not immediate, the farm may be rented as pasture or in favour of the best opportunities offered.

Many counties now have diameter limit by-laws to control cutting for sale. These are designed to stop the practice of clear-cutting or slashing woodland. In this type of operation everything that can be made into a salable product is removed from the woodland; this is definitely not according to good forestry practices. The natural process in such devastated areas, augmented by the negligence of the owner in pasturing, leads to the establishment of small woody shrubs such as raspberry, dogwood and many others. The land is lost to any economical use for many decades. It is wasteland.

In counties where diameter limit by-laws have

been enacted the practice of clear-cutting is reduced to cutting everything salable to the legal diameter limit. This again is not good forestry; however, it is preferred against absolute clear-cutting.

The woodlot owner may sell his sawlog material in one of three basic ways - lump sum method, at a price per thousand feet on the stump, or made into logs. Experienced log buyers can appraise the volume in a timber stand quite readily, and some can do it quite accurately. One operator visited prides himself on his ability in estimating. Whereas some buyers estimate the volume in only a percentage of the trees in the stand, he tabulates the species and volume of each merchantable tree. Actual records of woods operations show that he is consistently within 6 per cent of the measured log run. Some years ago in competitive bidding for 87 acres of woodland by the lump sum method he estimated the stand to be 700,000 board feet; the chief log buyer for a large furniture manufacturer estimated 350,000 board feet; another log buyer estimated 100,000 board feet. The log volume cut from the stand was 746,000 board feet.

(a) Lump Sum Transactions

The method of lump sum purchase is used to buy entire woodlots, all or certain species to a stated diameter limit or trees selected by the owner or the buyer. A lump sum purchase is based on a volume estimate by the buyer. In the case just cited each prospective buyer intended to use the bush to the same utilization standard, the manufactured product was intended for the same market, and so it is safe to assume that each put approximately the same basic value into his calculations for the lump sum bid. Obviously, under these conditions the sum offered by the buyer using the highest volume estimate would be the most attractive to the woodland owner. The buyer's risk in this purchase is reasonably secure because the basic price per thousand board feet that he uses is totally influenced by all the conditions and risks that experience has taught him to appraise in each purchase. The basic price represents what

the timber is worth to him standing. Thus in any lump sum purchase in an area where there is keen competition by log buyers the old law of supply and demand should bring the owner the best price for his timber that the market will pay. It is essential, though, that competitive bids be sought and from as many log buyers as possible. These buyers should represent all the fields of manufacturing from logs whose establishments are within economical operating distance of the woodlot. Standing timber is bought by scores of forest product enterprises; some of these are sawmills, furniture plants, basket plants, shoe-last block plants, cheese-box plants, brush block and handle plants, timber operators who get out rough pile or post or pulpwood products, and many others; or by middlemen who operate woodlands for sale to these enterprises. The seller is advised to consult the lists of buyers of woodland products held by the Department of Lands and Forests at its Zone offices.

Many of the larger timber operators prefer to purchase their requirements by the lump sum method. The most competent buyers can successfully offer winning tenders and leave themselves the necessary safety margin to take care of the logging chance. Realization on a venture is greater according to the buyer's ability to carry through the operations on a better cost sale ratio than was used in the calculations setting his lump sum bid. The buyer accepts this challenge to his abilities and in the long run hopes that the chance taken proves profitable. It is not always so. Buying logs in skids or delivered to the mill removes the financial risk in lump sum stumpage buying; it also removes the chance for the extra margin of profit which is a measure of his ability as a stumpage buyer and logger.

(b) Stumpage Rate Transactions

Selling at so much per thousand board feet puts the sale on a volume basis - volume removed is the payment basis - or what some millmen describe as an arguing

basis. The buyer may have agreed to cut the entire woodlot or all or certain species to a diameter limit or only selected trees. In any case the buyer has to measure the volume removed. In some cases the purchase agreement is a straight price per thousand board feet, but generally the buyer puts each log in one of two or three grades. The price schedule for the different grades might show the best type of log to be worth almost three times as much as the poorest grade of log, although the actual volume in the two logs is the same. (More is said about log grades in the following section on Stumpage Rates - Log Purchase Prices - Log Grades.) The woodlot owner does not know the business of manufacturing from logs and quite often feels he should dispute the log grader's allocation of certain logs to the low price category. Another strong reason for buyers wishing to purchase by the lump sum method is to avoid these arguments and the bad feelings which may result; often too such an owner puts the reputation of the buyer in a doubtful light prejudicial to the buyer's future business in the area.

Some buyers will only purchase by the lump sum method, but most will purchase by either the lump sum or volume removed basis. The woodlot owner must decide whether he would do better to take the lump sum offered and leave the risk of log grade and volume recovered with the buyer or sell at so much per thousand and accept the risk of the grade of the material that will be removed. What the buyer intends to cut and pay for should be absolutely clear to both parties. He might remove only the best trees and possibly only take the best logs of these trees. This leaves the owner with many poor quality logs that he cannot readily sell, with some poor trees standing that he wanted cut, and the volume actually paid for might be small. His total realization on the transaction might be less than by the lump sum sale method.

Whether the sale is by the lump sum method or on a per thousand basis, a written Timber Sales Contract should

cover the transaction. It should set forth all the details necessary as to prices, species, sizes, rights granted to the buyer, limiting dates, times of payment, and so on. There may be considerable differences between contracts depending on method of buying, standards of measurement, types of material involved, etc. It pays to deal with established reputable firms or buyers in the sale of woodland products. In many cases logs are transported 75 miles or more to a place of manufacture, or the owner is not resident near his woodland - it is in the interest of both parties to set forth their agreement in a written contract.

(c) Owner Log-Making

The woodlot owner may consider that he can realize labour income from sale of his timber if he sells it already made into logs and placed in a skid at the roadway, or delivered to the mill. Currently sawmills in the area pay about $20 per thousand more for logs delivered to the mill than is paid for standing timber. However, sawmill men say they would starve if they had to depend on the volume of owner-cut logs as the only source for their sawlog needs.

The majority of small owners do not log their own woodland. Some buyers would rather buy their requirements already made into logs, but often cannot persuade the owner to take advantage of potential returns from the woodlot harvest by doing his own woods work. The reasons for this are not too evident. It first must be agreed that woods work with heavy hardwood timber is dangerous to the inexperienced. Many farmers can tell of members or friends of their families who were maimed or killed in earlier days in woods operations. The average owner has not had much opportunity for experience; unless a woodlot is managed according to selective logging principles the opportunity for experience is not continual. Too many owners take absolutely no interest in their woodland - do not even take out fuelwood and instead buy coal or oil.

Professional power saw loggers can make up to 10,000 board feet of hardwood logs (Doyle Rule) per day. The high cost of the power saw is beyond the majority of farmers.

Experienced cross-cut felling gangs can make about 4,000 board feet of hardwood logs (Doyle Rule) per day.

In an age of specialization, experts in their fields and production line techniques set the price for the finished product or unit of work. Professional loggers set the price for felling, log-making, skidding and hauling. Their skills and production rates come from continuous experience. Realization for the various logging phases is most often paid by the buyer on a piece-work or volume-produced basis. Whereas by the piece-work rate the skilled operator might be well paid on a day rate basis, the unskilled farmer might be poorly paid, have actually worked harder, but much of the labour was wasted, and at the same time a poorer product was produced and considerably more damage is done the woodlot than by the skilled operator. At the end of the operation the "would-be" logger is probably much wiser, but most likely the profit is educational and not financial.

The needs of the buyers as to length and quality of logs vary from buyer to buyer, and time to time in the case of one buyer. Often a premium is paid for the product for which the buyer has great need. The quality of the log made rests largely with the log-maker by his choice of log length and thus the location of defects in the individual log. Proper appreciation of the effect of evident defects in a log is something the inexperienced cannot be told. Experience is required. The "would-be" logger may find after his logs are made that his price has been cut by a third because of some specification that he did not understand.

Modern logging equipment has also contributed to the elimination of the farmer-owner from the logging field. The gasoline-powered two-man chain saw greatly increases the output per man on a logging operation. Normally sawlogs are made by an experienced cross-cut gang at the rate of 1,000 to 2,000 board feet per day per man. Experienced chain saw gangs can make logs at 2,000 to 5,000 board feet per day per man. Currently felling and log-making is paid for at $5 to $6 per thousand. It is natural that the thought of the

apparent ease of power-sawing would make an owner hesitate to make logs by the laborious method of the cross-cut saw. The high cost (about $800) for power saws suitable for hardwood logging is beyond the average woodlot owner who has only limited use for such a saw unless he intends to do contract cutting. A given area can provide work for a relatively small number of power saws in relation to the number of woodlot owners and acres of woodland.

The skidding of sawlogs provides more farmer participation than any other phase of the logging operation. Skidding with horses is still the most satisfactory method for this phase of logging. Handling of heavy logs (a 16-foot, 24-inch diameter, hard maple log might weigh a ton) requires a good team, strong harness, and a capable teamster, particularly if the terrain is at all rough. Modern trends on the farm have in many cases replaced the heavy well-trained work horse with the tractor. Currently operators will pay $4 per thousand board feet skidded. However, many large operators have to maintain their own stables and permanent teamsters. The team and teamster are sometimes hauled by truck 75 miles or more to skid logs.

The hauling of logs to the sawmill is the unquestioned field of the specialized logging truck. Buyers currently pay on the average $10 per thousand for the delivery of logs from the skid at the edge of the woodlot to the mill. Even those owners who do carry out the logging operation are finding it necessary to leave log delivery to the truck.

Under present conditions of widely varied market requirements, small woodlot holdings and the tendency of specialization of labour in the field that was once well known to most of the rural population, there is little opportunity for the average farmer to profit by attempting to be also a log-maker among his many other accomplishments. Evidently the logging industry will continue to become even more closely associated with the purchasing field. It is a business with

Some damage in felling is inevitable even when the logging is done by expert cutters.

Log skidding to roadside for truck haul. This professional teamster and team were brought by truck more than 60 miles to do this skidding.

many problems which can most efficiently be solved by the experts. The owner would do best to confine his efforts to growing the best logs possible. The marking of trees for removal is a silvicultural problem and should be carried out on the advice of the Zone Forester or other trained personnel; proper treatment of the woodland in logging greatly influences the growth rate, form of the trees, regeneration, composition and other aspects important to the future of the residual stand. Labour income can be realized by working for the logger or removing smaller products such as posts and fuelwood. He will probably realize most from his woodlot by extensive soliciting of tenders when logs can be made in his woodland. There are not enough logs to be cut that all owners can hope to learn how to interpret the market requirements and carry out their operations successfully from a financial viewpoint.

The utilization of the smaller woodlot products which the farmer can readily make and handle himself is good forestry and good conservation. Some of these products are fuelwood, pulpwood bolts, posts and poles. The removal of these products from the woodlot will, if properly carried out, increase the productivity of the woodlot and the gross returns per acre. Very often it is the difficulty of marketing low-grade material which makes it almost impossible to carry out the necessary improvement work, and any means which can be discovered of utilizing small and poor-grade wood should be developed to the fullest extent.

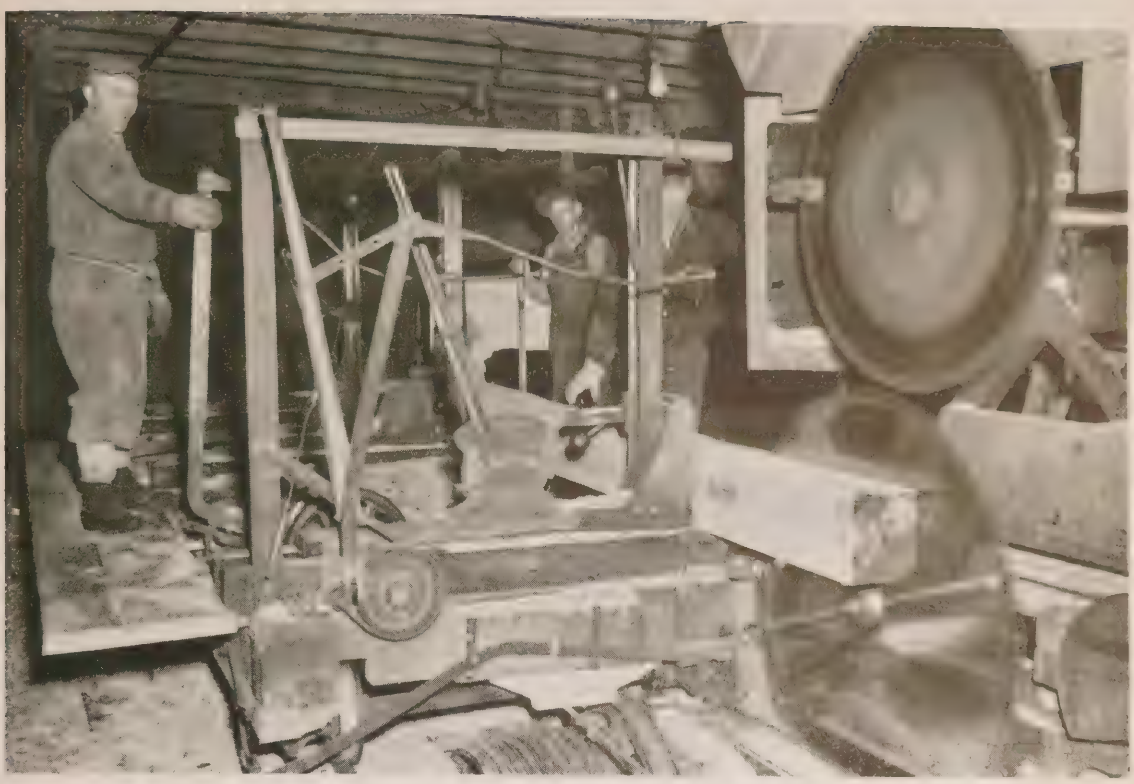
At the present time interest is increasing in the possibility of manufacturing wood chips in the woodlot by means of portable chippers. Such chips can be used for the manufacture of pulp for paper, and as bedding for cattle and litter for chickens which can subsequently be spread on fields to increase the humus content of the soil. They can be made from any species of wood and tops and branches can be utilized. The number of pulp companies which can use hardwoods is limited at the present time and only those making kraft paper can use

chips containing bark, but the demand for hardwood chips will increase and portable barkers are being developed. Every woodlot owner should consider the possibility of improving the quality of his woodlot by utilizing the low-grade material as chips.

11. Stumpage Rates - Log Purchase Prices - Log Grades

An owner may wonder, when the sale price at the mill for Select grade hard maple in two-inch stock is \$200 per thousand and at the same time the price he receives for standing maple may average less than \$40 per thousand for good trees. He should also note that No. 3 Common grade is probably selling at \$40 per thousand and is not paying the mill its costs - and that high grades represent only a small percentage of the mill run, generally less than 15 per cent in hardwoods. The operator has to handle, manufacture and market large quantities of product of marginal and submarginal sale value in order to offer to the market the small percentage of high grades which puts the economic picture of the operation in a brighter light - higher grades must carry the burden of lower grades.

The amount of lumber that can be sawed from a log depends on the skill of the sawyer, number of defects presen shape of the log, thickness of the boards or timbers cut and the amount of saw kerf. The defects may be evident surface defects or hidden defects. Some evident defects are checks, ingrown bark, ring shake, spiral or straight seams, "catface" knots, live knots, dead branch stubs, and centre defect. The effect on grade volume outturn of the various defects or combinations of defects is not easy to appraise. Only those with considerable experience at the head saw in a mill and in grading lumber can attempt this appraisal. Since probable grade output per log is important the buyer considers this when buying stumpage or logs. Generally operators classify logs in at least two



Boxed heart of a hardwood log. The best lumber, or the first and second grades, is obtained from the outside of the log just underneath the bark, with the centre giving the poorest grade. The top saw here allows handling of large-diameter logs.

Heated log pond. Washing of logs in a hot-pond reduces head saw maintenance and allows all-winter sawing. It is said there has been a mill at this site since 1828.

grades and often three or four. Prices paid are according to log grade.

Standard rules for grading logs do not exist. A first impression is that standards for woodlot products should be practical and would solve a lot of problems; that there should be some divisions in utilization for which standards could be established. When this theory is considered at length the problems that arise are many. To cover all the aspects of log-grading for the different market requirements would require at best a long, technical, cumbersome schedule. Considerable intensive study is required to find a practical solution to this part of the complicated marketing problem. It is expected that in the near future the Research Council of Ontario will undertake a complete study of the marketing of woodlot products. The results of this study may provide solution to some of the problems.

Some buyers attempt to keep log-grading on the simplest basis possible and may have only two grades, whereas other buyers feel they must have four grades. Under present conditions each buyer has his own grade specifications. Some times they are rigid but often are quite flexible. The specifications are rarely published and available as tabulated points for comparison with other buyers' grades. The log-grader simply keeps in mind certain basic principles and grades from knowledge of what can be produced from each log.

A good buyer, in making a stumpage purchase on a per thousand basis, will walk the woodlot with the owner and try to illustrate the various log grades according to external appearances. In this way the owner might get a fair idea of the probable log-grade run in his sale. Often, though, other defects become evident when the logs are made and degrading may result.

Some buyers in competing for cutting rights emphasize the attractive price offered by quoting their highest grade price. They do not mention that only a very few logs

Selective logging. The 21-inch maple in the foreground is blazed for removal while the 16-inch maple in the background has been left. At the smaller size hard maple is putting on its "quality growth".

Some operators do not pay their Grade 1 prices for logs with centre defect, while others do. Maple syrup spiles caused the small dark marks seen on this butt log.

will fall in this high price category, the majority of logs probably falling in the third grade. Sometimes a price list by log grades is provided but no case was encountered where the specifications for the different grades were also set forth in general terms. An owner would have a better opportunity to compare buyers' offers for a stumpage transaction if written grade specifications were set against the grade prices. In addition the owner should require the buyer to illustrate his grading principles as far as possible on the trees he wishes to sell.

Buyers' needs for timber are different and fluctuate and so the amounts they will pay also vary. There may be special orders or contracts beyond the general sales. Such orders might call for concentration on elm of hockey-stick grade, basswood of key-stock grade, maple for heel stock, and so on. In some cases the buyers will pay premium prices for special logs that will satisfy good contracts. In other cases an order may allow certain defects such as dark heart or sound knots which may not generally be allowed in the average sales of that species, and a heavy run of rough logs may be allowed at good prices to satisfy a contract. At another time such rough logs would be of no interest to the buyer.

Log price lists and grade specifications are shown for three operators. Price lists for logs by grades mean nothing to a seller without some indication of grading specifications. Operators find it difficult to outline grading points. Admittedly it is difficult if there is an attempt to show each grade's limitations absolutely. But it is a help to know the general limitations of some of the variables that guide the grader.

It is useful to the seller to know that a 16-inch hard maple log 16 feet long and perfect in every respect (veneer grade) is valued at $80 per thousand board

LOG PRICE LISTS 1950 - 1951 FOR THREE OPERATORS

WITH GENERAL LOG GRADE SPECIFICATIONS

SPECIES	OPERATOR "A" Log Grade No.1	No.2	No.3		OPERATOR "B" Log Grade No.1	No.2	No.3
	$	$	$		$	$	$
WHITE OAK	75		35	Clear - 18" diam. & up	85	55	30
RED OAK	60		35		85	55	30
HARD MAPLE	75	55	35		80	50	30
WHITE ASH	70		35		70	50	30
BASSWOOD	70		35		70	45	30
BLACK CHERRY	65		35		70	45	25
WHITE ELM	50		35	Good - 18" diam. & up	50	30	20
ROCK ELM				Good - 15" diam. & up	55	30	20
BEECH	50		35		45	30	20
BUTTERNUT					70	45	35
BIRCH					45	35	20
POPLAR					25	15	--
SOFT MAPLE					55	35	--
HICKORY					55	30	20
CHESTNUT					40	30	20
WILLOW							
WHITE PINE	Straight price 75				70	55	35
HEMLOCK	Straight price 70				45	30	--
TAMARACK							
SPRUCE							
CEDAR					33	23	

OPERATOR "C"

SPECIES	Length of Log 6'	8'	10'	12'	14'	16'	Special Prices for Good Diameters
	$	$	$	$	$	$	$
WHITE OAK	45	50	60	75	80	85	Over 16" diam.& 16' long 90
RED OAK	45	50	60	75	80	85	Over 16" diam.& 16' long 90
HARD MAPLE	40	50	60	70	75	80	" 16" " " " " 85
WHITE ASH	40	45	50	55	65	75	" 16" " " " " 80
BASSWOOD	40	50	60	70	75	80	" 15" " " " " 85
BLACK CHERRY	40	45	50	55	65	70	" 16" " " " " 75
WHITE ELM	40	45	50	55	65	70	" 16" " " " " 75
ROCK ELM	40	45	50	55	65	70	" 16" " " " " 75
BEECH	25	30	40	40	45	50	" 16" " " " " 55
BUTTERNUT	40	50	60	70	75	80	" 15" " " " " 85
BIRCH	40	50	60	70	75	80	" 16" " " " " 85
POPLAR	25	25	30	35	40	45	
SOFT MAPLE	35	40	45	50	60	65	" 15" " " " " 70
HICKORY	40	45	50	55	65	75	" 16" " " " " 80
CHESTNUT							
WILLOW	25	25	30	35	40	45	
WHITE PINE	40	50	60	70	75	80	" 16" " " " " 85
HEMLOCK	30	40	45	45	50	55	" 16" " " " " 60
TAMARACK	25	25	30	35	40	45	
SPRUCE	30	40	45	45	50	55	" 16" " " " " 60
CEDAR	30	40	45	45	50	55	" 16" " " " " 60

SPECIES	Length of Log 18'	20'	22'	24'	26'	28'	30'	32'
	$	$	$	$	$	$	$	$
WHITE OAK	90	95	Over 16" diam. - no defects - knots sound					
RED OAK	90	95						
WHITE ELM	75	80	Over 18" diam. - sound & straight - knots no defects					
SOFT MAPLE	75	80	Over 18" diam. - sound & straight - knots no defects					
WHITE PINE	83	86	90	92	94	96	98	100
HEMLOCK	58	61	64	66	68	70	72	74

Prices of Operators "A","B","C", are per M Bd. Ft. log scale (generally Doyle Rule) delivered to the mill.

If the log seller does not carry out the operations of cut, skid, and haul to the mill, the operator reduces the above prices on a per thousand basis generally $10 for haul, $5 for skid and $5 for cut. These are the average costs to the operators for these operations in the area studied.

Above prices are for No.1 Grade logs

For No.2 Grade logs deduct $5 per M

For Cull and Old Logs deduct $10 per M

$100 per M for "Veneer Quality" oak, hard maple or birch

$5 per M over above prices for "white" basswood

$5 per M over above prices for "clear" white pine

Note - Logs over 16' long are scaled twice, at small end and at centre of log.

GRADE SPECIFICATIONS OF OPERATOR "A"

Grade	Length	Diameter small end inside bark	Maximum allowable defect
1	8' up	18" up	up to 3 knots or indications of knots or injuries when 1 in middle and other 2 at same end fairly straight no centre defect
2	8' up	18" up	up to 5 knots or similar defect but 2 sides clear some crook allowed centre defect allowed - gross scale reduced
3	8' up	below 18"	logs that will not grade up to #2 because of imperfections or diameter

Hard maple has 3 grades designated No. 1, No. 2 and No. 3.

All other hardwood species have only 2 grades designated No. 1 and No. 3.
Grade 1 specifications are according to No. 1 above
Grade 3 includes all other logs

White pine and hemlock are not graded. Entire log run is accepted in the one price category.

GRADE SPECIFICATIONS OF OPERATORS "B"

Grade	Length	Diameter small end inside bark	Maximum allowable defect
1	8' up	no rigid requirement, but 14" is desired (some species are qualified as to diameter in price list)	2 knots or indications of knots or injuries when other three sides clear up to 5 small knots if all on one side and rest of log is very good fairly straight centre defect allowed - gross scale reduced
2	8' up	no rigid requirement	5 or 6 knots if fairly good log some crook allowed centre defect allowed - gross scale reduced
3	8' up	no rigid requirement	rough logs that will not grade up to #2 (not many logs graded as #3 in last few years)

GRADE SPECIFICATIONS OF OPERATOR "C"

Grade	Length	Diameter small end inside bark	Maximum allowable defect
Veneer Quality	Prices vary throughout all grades according to log length	not obtained (1) generally the veneer trade requires a 16" minimum with some acceptance of sizes down to 14" and occasionally lower	clear, no knots or indication of knots or injuries straight round very little taper no centre defect
1		no rigid requirement premium paid for good diameters and lengths	4 to 6 sound live knots depending on diameter and length of log fairly straight
2		as for #1	many knots considerable crook considerable spiral grain
Cull & old logs			extensive shake rotten knot holes logs left over from previous year (2)

(1) The system of log grading of this operator was under revision.

(2) Winter cut logs generally begin to decay or "sour" at the ends by mid-August in Southern Ontario.
Logs lying on the ground may sap rot if left too long or develop severe check.
Some species are susceptible to insect injury.

Without grading specifications in simple tabulated form, as well as log prices, the log seller is at a distinct disadvantage in selecting the best market for his logs. The seller rarely has opportunity to compare the grading points of different operators. The grading specifications shown are the answers given by the operators to direct questions.

feet by Operator "B", at $100 by Operator "C"[1], while Operator "A" puts it in Grade No. 3 at $35 per thousand because it does not meet his 18-inch diameter specification. A 20-inch hard maple log 16 feet long with a 3-inch centre defect but otherwise perfect is still worth $80 per thousand to Operator "B" who reduces the volume measure of the log an amount equivalent to the defective part; Operator "A" does not tolerate centre defect in Grade No. 1 and puts the log in Grade No. 2 at $55 per thousand. The premiums paid for lengths by Operator "C" indicate his interest in construction timber.

Much of the skepticism in the minds of woodlot owners toward dealings with log-buyers would disappear if there was less obscuring of their grading standards. Some buyers feel they must say that they operate with "open books". Generally this is true. A good way to show this is to publish price lists and general log-grade specifications together.

12. Mill Products

(a) Direct Products

The production of all mills visited is chiefly rough air-dried hardwoods, softwood production being less than 25 per cent of the total; the extent of further manufacture such as planing is insignificant.

The bulk of the output of mills operating on a professional basis is shipped to industrial plants for further manufacture. Some of the larger mills produce large quantities of structural lumber intended for use where working stresses are important.

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1. Operator "C" has a special veneer grade price, although he does not use these logs for veneer; instead they are sawn for special stock. He has established this grade in order to compete against log-buyers purchasing for veneer plants. Veneer logs have to be very high quality and the percentage in an average stand is generally very small. They are purchased at high prices. Thus this operator can point out to the woodlot owner that he will pay "veneer prices" for any veneer logs in the log run.

At least two of the mills manufacture railway cross-ties; the species used for this purpose are hard maple, beech, oak and ash. Hornbeam is utilized by one mill in the manufacture of transformer rollers for the Ontario Hydro-Electric Power Commission. Hornbeam is highly preferred for this use but local short supply has recently necessitated the use of hard maple and rock elm.

(b) By-Products

The slabs produced at the mills and the tree tops of the woods operations find a ready market as fuel, particularly in the large centres of population. In the Paradise Lake area white pine slabs are sold for rustic siding in summer cottage construction. Cedar poles and posts, recovered incidental to other woods operations or definitely sought as a marketable product, find a ready market, and considerable cedar is brought in from northern points to alleviate local shortage.

Current prices (1950 and 1951) paid at one mill for cedar posts 8 feet long and of sound stock are shown by diameter classes:

Diameter small end:	8"	8½"	9"	9½"	10"	10½"	11"	11½"	12"
Price each: $	.80	.85	.90	.95	1.00	1.05	1.10	1.20	1.25

Fuelwood prices (1950 and 1951) of two operators are shown. Prices are for standard cords of 128 cubic feet - hardwood species.

	Operator No. 1	Operator No. 2
Slabs in stove lengths at mill	$9.50 for hard maple, beech, cherry and ash $6.50 for elm and soft maple	$10.00 ($12.0C delivered)
4-foot lengths from bush operation stacked in bush	$9.00 to $9.50 for better species $6.00 for elm and soft maple	$12.00 best species and sizes $ 8.00 poorer species and sizes (Add $4.00 for delivery)

The labour for the bush operations is paid for at the rate of $4 per cord. A man described as a hard worker and a good cordwood maker made an average of 2.3 cords per day over a seven-day period.

One operator pointed out that county diameter limits on logging operations have put out of business "those people making fortunes out of fuelwood sale". The small diameter trees (6 to 12 inches) made excellent fuelwood at a fast rate, whereas tops of logging operations are more difficult to make into fuelwood and do not bring such good prices as the material is rougher and there is less body-wood. In addition the operators must pay less for woodlots purchased on a lump sum basis because the buyer's realization on fuelwood is reduced.

13. Product Outlets for Local Mills

As improved roads and increased efficiency of motor trucks have tended to put portable mills on a basis of permanent location, they have also given the mill-operator a greater latitude in merchandising the mill products.

Essentially, the outlets for the products of small mills can be given four basic categories:

(a) Local farm consumption
(b) Local retail outlets
(c) Wholesalers
(d) Special industries.

(a) Local Farm Consumption

Most of the mills producing annually 75,000 board feet or less are farmer-operated. These represent 57 per cent of the total number of mills visited, do less than 10 per cent of the total sawing, and 62 per cent of their output is custom. Some of these mills operate only a few hours a day for only a few weeks of the year. Many of their owners use a considerable amount of the product themselves. It is estimated that about 20 per cent of the production of the 28 mills visited finds its way into miscellaneous uses about the farm.

(b) Local Retail Outlets

Only a very small part of the production is sold through independent local retail yards; most of the softwood production which is not custom work is sold locally. Generally more than 90 per cent of retail yard turnover is softwoods brought in from other parts of Canada and, of the 10 per cent handled which is hardwood, 90 per cent or more is "imported" hardwood flooring. This reduces the purchase of local hardwoods by retailers to a very small volume.

(c) Wholesalers

The lumber wholesaler acts as a middleman between the producer and ultimate industrial consumer. Local and regional concentration of wood-using industries, brought even closer to the producer by modern truck transport, allows direct dealings between the producer and consumer and eliminates the wholesaler almost entirely, relative to the mills visited.

(d) Special Industries

Since 75 to 80 per cent of the total output of all the mills visited is hardwoods and hardwoods find only restricted use, relatively, in building, then the bulk of production must find outlet in the special industries category.

Half of the mills ship direct to the manufacturers for industrial consumption. These mills produce about 85 per cent of the total production of all the mills visited. Most of their product is for market; thus special industries are by far the major outlet for sawmill products in the area studied.

The principal industrial consumption is by the furniture factories of Kitchener, Waterloo, Preston and Listowel. On the basis of 1948 reports to the Dominion Bureau of Statistics, the furniture factories in the twin cities of Kitchener and Waterloo consume more than $7\frac{1}{4}$ million board feet of hardwood lumber annually. This volume is greater by about $1\frac{1}{2}$ million board feet than the annual hardwood production of

all the mills visited. The chief local species involved are hard and soft maple, soft elm, basswood and beech; and lesser quantities of ash, oak, cherry, rock elm and poplar.

Other industrial markets for local hardwoods include an extensive list of manufacturings, such as farm implements, industrial trucks, wooden heels, caskets, brush blocks and broom handles, bowling-alley equipment, children's playthings, sporting equipment, stair tread and furniture trim.

There is some export of select grade hard maple in the larger sizes to the American market. Considerable quantities of low-grade hardwood are sold to heavy-machinery manufacturers for crating and factory skids.

14. The Marketing Problem

The marketing problem has three closely related aspects:

(a) The woodlot owner who has merchantable trees that will make sawlogs. The sale of his woodlot increment should be a paying proposition the same as any agricultural enterprise.

(b) The professional or semi-professional sawmill-operator who requires logs that he can mill into lumber on a paying basis.

(c) The ultimate industrial consumer who requires definite quantities of certain species in certain grades in order to carry on his annual manufacturing on a paying basis.

These aspects resolve into getting the woodland products to the mills in sufficient quantity to make their handling profitable to the woodlot owner and the sawmiller, and assuring the consumer a continuous supply of standard grades at fair prices.

In the past the farmer has been at a disadvantage in marketing logs from his woodland. In lump sum sale he must rely on his ability as a trader to strike the best possible bargain with the buyer. He is unfamiliar with methods of estimating the quantity and value of his merchantable timber; experienced foresters find it difficult to estimate accurately cull and quality when appraising timber,

particularly hardwoods, which predominate in the area studied. The buyer has had experience in this field and in addition allows a safety margin on the estimate. Furthermore, operators of small mills and portable mills are often at a disadvantage in marketing their lumber and so are not in a position to pay full value for standing timber. Sale methods involving stripping the woodland ruin the woodlot for decades to come. Sale by set price per thousand board feet removed gives the operator the right to cut all or certain trees above a specified diameter and to take only those portions of the trees he wishes and to pay for only the portion he takes. This pattern of sale removes the uncertainty of the cull and quality factors but introduces the question of how much of the timber cut will actually be taken; it often is high-grading the woodlot and "creaming" the logs of the felled trees. Thus a high price offer per thousand on the stump may bring a lower price to the farmer than the lump sum method. The log scale used in buying standing timber introduces another variable. Opportunity for sharp practice in scaling the felled logs exists, particularly when allowance is made for cull in defective timber. However, in fairness to log-buyers it must be said that the majority are not of the type just mentioned.

The professional or semi-professional sawmiller requires assurance of log supply. The complete lack of interest by the majority of woodlot owners in any form of logging operation of their woodlots forces him to sell the idea of log sale to the owners. To assure log supply to his sawmill he is in many cases forced to buy woodlots in order to plan his milling for the year. Sporadic supply by purchase on the open log market is too indefinite. In buying woodland for a season's milling he may acquire such volume as to remove strong interest in log purchase in small quantities from individual farmers. The disposition of his cut is often quite a problem. The preponderance of low grades in average

Farmers often do very little of the woods work. This lump sum purchase bought only the logs that could be made. The farmer paid the buyer's cutting crew to make the tops and limbs into 4-foot fuelwood.

Poor piling of random lengths. The grade of lumber is often lowered during seasoning due to poor piling practices which encourage warping.

hardwood milling, in many cases increased by poor sawing equipment and techniques (especially degrading due to poor piling), make efficient grading and separate piling of the many species sawn a serious problem. The resulting common practice is mixed-grade piling and forces him to deal lumber piles at reduced prices rather than at good prices by specific grades. His established market has considerable dependence upon mutual goodwill with the purchaser.

The industrial consumer most often requires quantities and specific grades in large lots of a carload (approximately 20,000 board feet) and up. He desires well-sawn products of standard widths and thicknesses. Most large consumers must "import" other than local species from large mills which also handle large quantities of well-graded woods which may be sawn locally. It is more practical from his point of view to pay the extra freight costs involved to be assured of continuous supply of species and grades as required than to "shop around" in the uncertain local supply market.

15. Attempts at a Solution of the Marketing Problem

(a) A Marketing Experiment near Doon

During the winter season of 1948 and 1949 the Department of Lands and Forests in the Galt Zone carried out an experiment in the marking and marketing of timber in an 18-acre woodlot near Doon. The project was initiated by Mr. I.C. Marritt, the District Forester, and the field work was done by Mr. L.S. Hamilton, Zone Forester. The scheme is patterned after a marketing assistance method meeting good success in the State of New Jersey.

The mixed uneven-aged woodlot contained considerable large white pine and red oak. Initial investigations by the Department showed growth stagnation due to overstocking and recommended the removal of certain trees representing the accumulation of growth over a number of years. Under this

condition, removal of selected trees reduces the growth stagnation factor and the remaining trees grow at an increased rate. As growth again slows down, another cropping should take place. This is the simple principle of selective logging - the removal of accumulated growth periodically to keep the stand at a healthy productive growth rate.

Upon explanation of the proposed marketing assistance, the woodlot owner entered into a signed agreement with the Department as a co-operator, agreeing not to sell or allow to be cut any trees except those marked, upon penalty of a nominal fine per thousand for the estimating and marking service of the Department.

The trees were marked with a view to a second marking which would be necessary afterwards to remove weed trees and trees of low value in order to give good growing conditions. Each tree marked for removal was blazed at breast height and below stump height; the stump blaze being branded to detect any unauthorized cutting. The total log scale estimated for the 223 trees marked was 47,600 board feet Doyle Rule. The trees were tabled as to species and diameter on a mimeographed form.

All the estimation data were turned over to a timber agent chosen by the Department. The timber agent entered into written agreement with the owner to

(1) solicit tenders from buyers;

(2) draw up a timber sale contract protecting the owner;

(3) check on cutting operations; and

(4) measure and collect payment for all wood cut before its removal from the property.

The agent was to receive a percentage commission of the gross sale value.

The timber agent mailed the volume estimate sheets to all local log buyers, giving location of the woodlot and inviting inspection of the bush.

The timber sale contract set forth the prices agreed upon for the different species, required that tops be worked into 4-foot wood to be paid for at an agreed price per standard cord, provided penalties for the cutting of unmarked trees, and required that the woods operation be conducted with a minimum of damage to the woodlot.

Prices realized by the owner were much better than the average paid in the area. Prices per thousand board feet Doyle Rule for the standing timber were:

White and red oak $62

White ash, soft maple, hard maple, basswood and cherry $60

White pine $55

Hemlock $45

Beech $30

Fuelwood .... $4 per standard cord

The experiment was considered very successful by all the parties concerned, yielding about 2,000 board feet more than estimated, and the woodlot has been left in fine growing condition with an expected second cut in fifteen or twenty years of 25,000 board feet.

(b) Forest Products Co-Operative in New York State

In Otsego County in New York State local interest in forestry, stimulated by critical needs arising from the depression, resulted in the organization of the Otsego Forest Products Co-operative Association at Phoenix near Cooperstown in 1935 as a farmer co-operative under the co-operative corporation laws of New York State. In its certificate of incorporation the objectives of the Association are stated:

> "To promote, foster, and encourage the better care and increased productivity of woodlands, the orderly and efficient marketing of forest products through co-operation to eliminate speculation and waste, and to stabilize the marketing of forest products."

A survey covering a radius of 35 miles from Cooperstown indicated about 2 billion feet of merchantable timber, a fair portion of which could be available to the Co-operative. In 1937 a loan was arranged with the Farm Security Administration to construct and operate a farmer-owned processing plant. Since that time this Association has afforded farmers within an increasing radius (now about 50 miles and occasionally up to 90 miles) an opportunity to practise forestry in conjunction with their usual farming enterprises on a basis that assures equitable return from any species and grade of product in whatever quantity offered. The program requires change from the common stripping of woodland and of utilizing only the best trees of a few species, to selective logging and diversified utilization, whereby the forests will be managed for a continuous high-value yield.

Otsego County, in which the centre of the mill-servicing area is located, is not unlike much of Southern Ontario. The county is dominated by dairying; about 62 per cent of the land is used for crops and pasture; 28 per cent is in forest; the remaining 10 per cent is abandoned farmland (reverted to brush), water, roads, marsh, building sites, and so on.

The Association is composed of members and operated by a Board of nine Directors elected by members at an annual meeting. The Manager is appointed by the Board and is assisted by an office manager, a complete mill crew, and fieldmen who handle member contracts and all phases of the field activities.

To become a member a person must be a woodlot owner, must purchase five shares of common stock at $1 per share and must sign the Association's Marketing Agreement. The member thereby agrees to manage his woodlot according to good forestry practices and to sell any sawlogs cut by him for sale to the Co-operative and to accept 5 per cent

of the value of his logs in common stock. Members receive patronage dividends. The Association agrees to assist the owner in applying good forest practices to his woodlot and to publish prices and grading specifications for logs on a delivered-to-the-mill basis and, should it be unable to handle the member's forest products advantageously, to give permission to sell them elsewhere. Lumber needs of members are met at wholesale prices at the mill. By 1941 the Association had a membership of over 600; this had increased to almost 1,100 by the spring of 1950.

The Association's fieldmen will, on request and without charge, cruise a member's woodlot and mark for cutting, telling him the number and volume by species of trees in his woodlot and the physical condition of the stand. The marking viewpoint is to improve the woodlot by removal of mature trees and leave the young and medium-sized trees of commercial species to grow.

The plant of the Association is modern and equipped to get the most out of the log at a minimum of cost and waste. It has a hot log-pond, a modern band mill, a small circular mill, edgers, trimmers, slabsaws, planing mill, small resaw, and mechanical conveyors to the sorting and grading deck. The equipment is powered by electricity and steam. A very important feature of the plant is its battery of dry kilns. There is rail service into the mill-yard.

The mill annually cuts between $2\frac{1}{2}$ and 3 million board feet of lumber, which holds consistently to 66 per cent hardwood and 34 per cent softwood. Mill operation is on a three-day week basis, it being established that full-time operation would too rapidly deplete the timber resources of the area which can be economically serviced. The 12-man crew works the remainder of the week on lumber handling. The daily cutting rate is 20,000 board feet of softwood or 15,000 to 16,000 board feet of hardwood.

The Association publishes a leaflet every two months which is sent to each member. It describes activities and facts about the Association, and farm forestry practices in general which are of interest to the members. Through it the members are posted on current log prices at the mill by species and log grades and the standard log grades of the mill are set forth in detail. The following is the log-grade specification and log price list effective August 1, 1950.

LOG PRICE LIST

PRICE: (Per M Doyle Scale Delivered at Plant, Phoenix Mills, N. Y.)				
Species	Log Grade			
	Select	No. 1	No. 2	No. 3
	Price per M Bd.Ft. ($)			
A Hard Maple Ash Basswood Black Cherry Birch	60.00	50.00	33.00	18.00
B White Pine	60.00	50.00	38.00	18.00
C Red Oak Butternut	47.00	37.00	30.00	18.00
D Beech Elm Soft Maple	35.00	30.00	23.00	18.00
E Hemlock $39.00 per M for logs, 8,10,12,14 foot lengths $42.00 per M for logs, 16,18,20 foot lengths				

Demonstrating in many ways the economic advantages of co-operative action, the Association has largely overcome many of the obstacles that make intensive forest management on a continuous yield basis impractical without a market that will absorb all classes of products, pay fair prices and accept delivery in small quantities from

LOG GRADE SPECIFICATIONS

HARDWOODS *					
Grade	Lengths	Diameter small end	Maximum crook	% of gross scale allowable rot, sweep, etc.	Surface requirements on each of the 3 visible faces or sides
Select	12'3" - 16'3"	16" up	2"	10	Clear; no knots or indications of knots
1	12'3" - 16'3"	12", 13"	3"	25	Clear entire length
	10'3"	14"	3"	25	Clear entire length
	12'3" - 16'3"	14"	3"	25	80% clear in 1 cutting
2	8'2" - 16'3"	10" up	3"	40	Clear entire length
	10'3" - 16'3"	10" up	3"	40	2/3 clear in not over 2 cuttings each not less than 3' long
3	8'3" - 16'3"	10" up	4"	40	40% clear in cuttings not less than 3' long

Note for maple: Select logs cannot have more than 1/3 of diameter and 1's and 2's more than 1/2 of diameter in black heart or mineral streak.

WHITE PINE **					
Select	12'3" - 16'3"	16" up	1"	5	Surface clear; have no knots or red rot, and no indication of knots near surface
1	12'3" - 16'3"	12" up	2"	25	Any number of sound tight knots not over $1\frac{1}{2}$" in diam. No red rot
2	8'3" - 16'3"	10" up	3"	40	Any number of sound tight knots not over 3" in diameter
3	8'3" - 16'3"	8" up	3"	30	Logs suitable for lumber that will not grade up to #2 because of imperfections

HEMLOCK **					
Merchantable	8'3" up	8" up	3"	30	No requirement

** Note: No dead hemlock and pine logs will be accepted unless they have at least 14 inches diameter of sound heart wood.

widely dispersed farm forestry enterprises.

(c) The Lanark County Co-Operative

Mr. W. E. Steele, District Forester at Kemptville in Grenville County, supplied the factual data upon which are made the following comments on the Lanark County Co-operative for marketing woodlot products.

The Co-operative was set up by a group of woodland owners in the County of Lanark in March 1950. Its objectives are the better management of privately owned woodland to ensure a continuous yield of the best material possible from the forested land of the members through profitable marketing of all the woodland products.

To put the woodland enterprise on a paying basis to the individual it is necessary to market not only the material suitable for lumber manufacture and special products such as veneer, but also the inferior products such as the poorer hardwood species, low-grade hardwood logs of the better species, small softwood products such as cedar posts and poles, and that material removed in improving a woodlot during what may be called sanitation cuttings. It was felt that the advantages of co-operative action by woodland owners in the field of marketing would best solve the problems of the individual, particularly in respect to inferior or small products. Acting as a group rather than individually and through a member active in contacting prospective buyers, they can hope for recognition by the buyers in the area as a stable source of the various woodland products.

The establishment of the Co-operative followed an extensive educational campaign carried on by fieldmen of the Federation of Agriculture, the Department of Lands and Forests, and the local Farm Forum leader. Interest was aroused through moving-pictures, talks at schools, local evening meetings, press releases, radio programs and public speaking competitions on woodlot management. Meetings held

at Lanark were attended by officers of the Department of Lands and Forests; representatives of pulp and paper companies, sawmills, and other wood-using industries; and members of agricultural organizations. Gradually a workable plan was evolved and the Lanark Forest Co-operative was set up under a number of directors with Mr. Herb Paul as manager.

Mr. Paul of Lavant, the main force behind the formation of the Co-operative, is an energetic leader of the local Farm Forum, caretaker of the Lanark County Forest, a farmer and owner of several hundred acres of woodland in Lavant Township. As manager of the Co-operative his duties entail the location of markets for the woodland products of the members, arriving at satisfactory price schedules, collection of payment for products, ensuring that products are ready or delivered at the time promised, and advising members on cutting their woodland according to best forestry practices.

By the fall of 1950 membership in the Co-operative was approximately 60, with an increasing interest in its operations prevalent. The membership fee is $5 and in addition the Co-operative takes 5 per cent of the sale proceeds of products handled. The member pledges to supply the quantity of material at the time and place agreed and to practise woodlot management according to conservation principles.

At present the Co-operative has no intention of undertaking a manufacturing endeavour such as a sawmill for lumber or railway ties. Logs are not accumulated at a central point and sorted as to species and a grading standard, but are handled direct from woodland to buyer. The purchaser's measure of the volume, by grade where it might apply, is accepted as the basis for payment on transactions.

An objective of the Co-operative, stated as the better management of privately owned woodland to ensure a continuous yield of the best material possible, is a

highly commendable aim. However, the statement embodies a tremendous amount of field work on the part of those capable of advising on the subject of woodlot management. This is a job requiring experienced field personnel. At present, although the Department of Lands and Forests is following this development in marketing with interest and co-operation, it has not the staff of extension foresters to provide the many owners of farm woodland with the guidance that is necessary. If the farm woodlot is to assume its place in the economics of the farming enterprise it must be shown that it pays in dollars and cents to the owner. The average woodlot owner cannot afford to carry on practices at a financial loss in the interest of the region or posterity. If, in its infancy, the Co-operative manages to make dollars and cents for its members by the sale of those products generally difficult to market as well as those relatively easy to market, and does the best it can toward field guidance on woodlot management for perpetual yield, then it will have done a lot toward good forestry in its area.

WATER

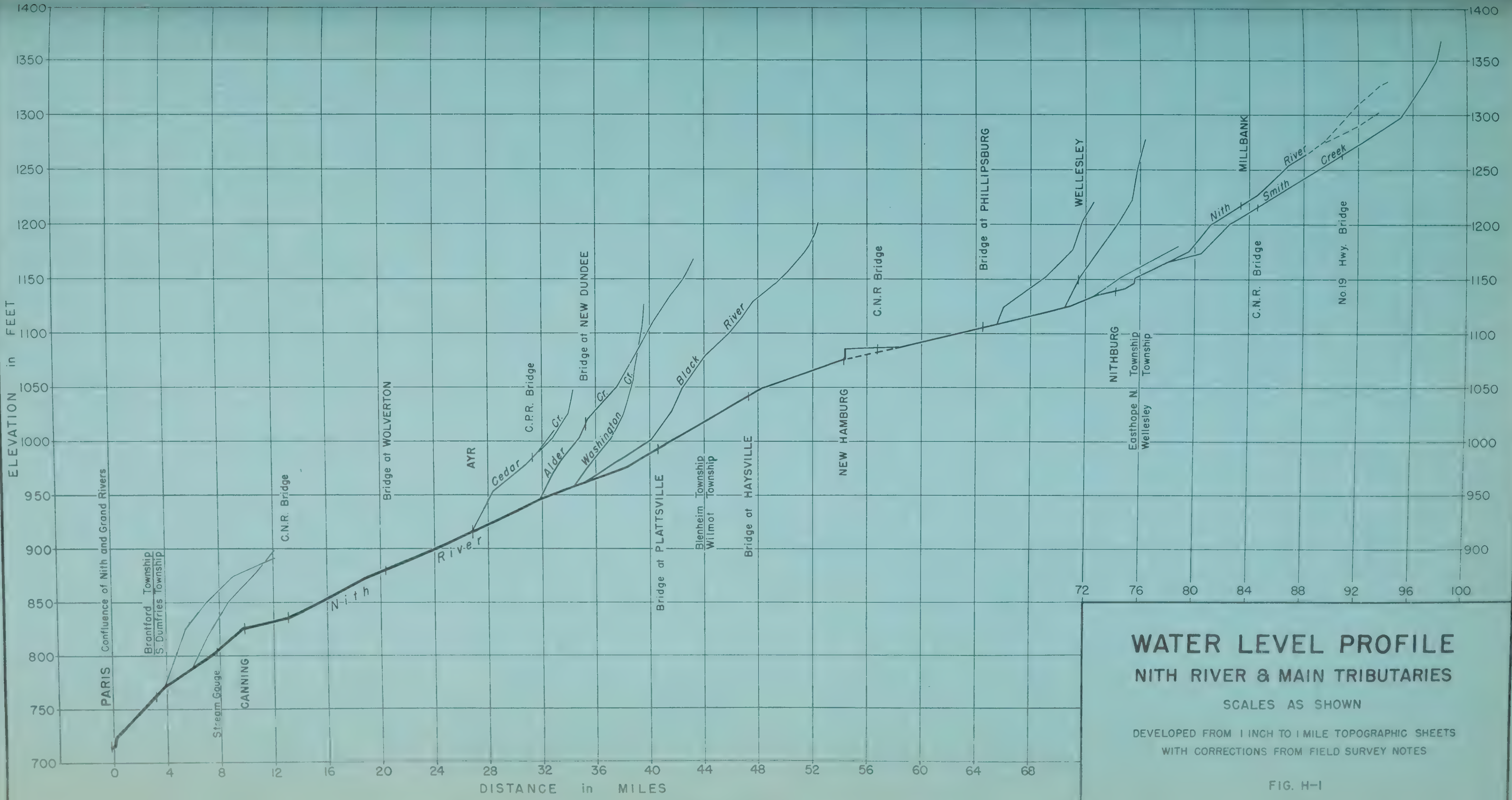
CHAPTER 1

HYDRAULICS IN GENERAL AND ITS RELATION TO CONSERVATION

Hydraulics as applied to conservation deals with the measurement and control of run-off from river drainage basins. Measurement has to do with such factors as precipitation - both rain and snow - the topography and vegetative covering of the area and the daily gauging of the flow of the river at selected points. Control deals with the prevention of floods by the use of reservoirs and other structures, and the increase of summer flow.

Floods which are caused by the natural run-off from river basins have occurred from time to time in Southern Ontario ever since records were first kept. Evidence of these can be found in diaries going back well over 150 years and from newspaper records for at least 100 years. Most of this run-off occurs in the spring, with the result that there is too much water in our rivers at the time of the year when it is needed least and very little, if any, during midsummer when it is required most. In addition to the flooding which is caused by spring run-off, occasionally floods also occur during the summer on watersheds which have little natural protection. These summer floods do serious damage to crops. Such floods are not confined to a few of our largest rivers, but records show that all rivers of any consequence have from time to time caused serious damage in this way.

When Ontario was mostly covered with forest and the natural reservoirs, such as large swamps, had not been interfered with, severe flooding probably was not as frequent as it is today because these two factors had an ameliorating effect on the flow of water. Land clearing and drainage were necessary to open up the country for agriculture, but in some respects these were carried beyond the point of necessity, thereby aggravating the flood situation. In order now to regain a more or less stable condition of the rivers and streams,



WATER LEVEL PROFILE

NITH RIVER & MAIN TRIBUTARIES

SCALES AS SHOWN

DEVELOPED FROM 1 INCH TO 1 MILE TOPOGRAPHIC SHEETS WITH CORRECTIONS FROM FIELD SURVEY NOTES

FIG. H-1

certain conservation measures must be carried out, such as the reclaiming of large swamps and water-storage areas, the reforestation of marginal and submarginal land, and also by a program of proper land use as indicated by farm planning, whereby run-off from gently sloping land can be controlled by such methods as contour cultivation and grassland where such is indicated. Such methods aim to control water where it falls on the land. If this could always be done it would be the ideal solution of the flood problem. But to minimize the required flood storage in a large watershed, a program of improved land use would need the co-operation of a great many individual farmers. This would take many years to accomplish. More immediate measures are therefore also necessary, especially where urban centres are frequently flooded.

One of the first problems facing the hydraulic engineer is to estimate or measure the run-off from a drainage basin which causes flooding farther down the valley. This includes a careful examination of rainfall over the years at different times of the year, which in turn presupposes that weather stations have been established in the area. Topography, types of soil, the amount of vegetative covering, particularly tree growth, on the area, and the gradient of the river, which has a bearing on the rapidity with which the water travels to the river's mouth, must all be carefully studied. If no gauging stations have been established then the run-off must be computed by taking the above factors into consideration and an approximate figure of flow is then determined, by comparison with a neighbouring drainage basin which has gauge records, in order to decide how much protection by the use of reservoirs is required. If, on the other hand, gauges have been established, by which a daily record is kept of the amount of water going down the channel at certain points, then a more accurate determination can be made of how much protection is needed. Fortunately daily flow records for the Nith River at Canning are available and although the periods

NITH RIVER AUGUST 1949

Upper: River at Paris. In summer the river is a sluggish stream of muddy water.

Centre: River at New Hamburg. Refuse dumps and heavy overgrowth have almost completely choked off the channel at this point.

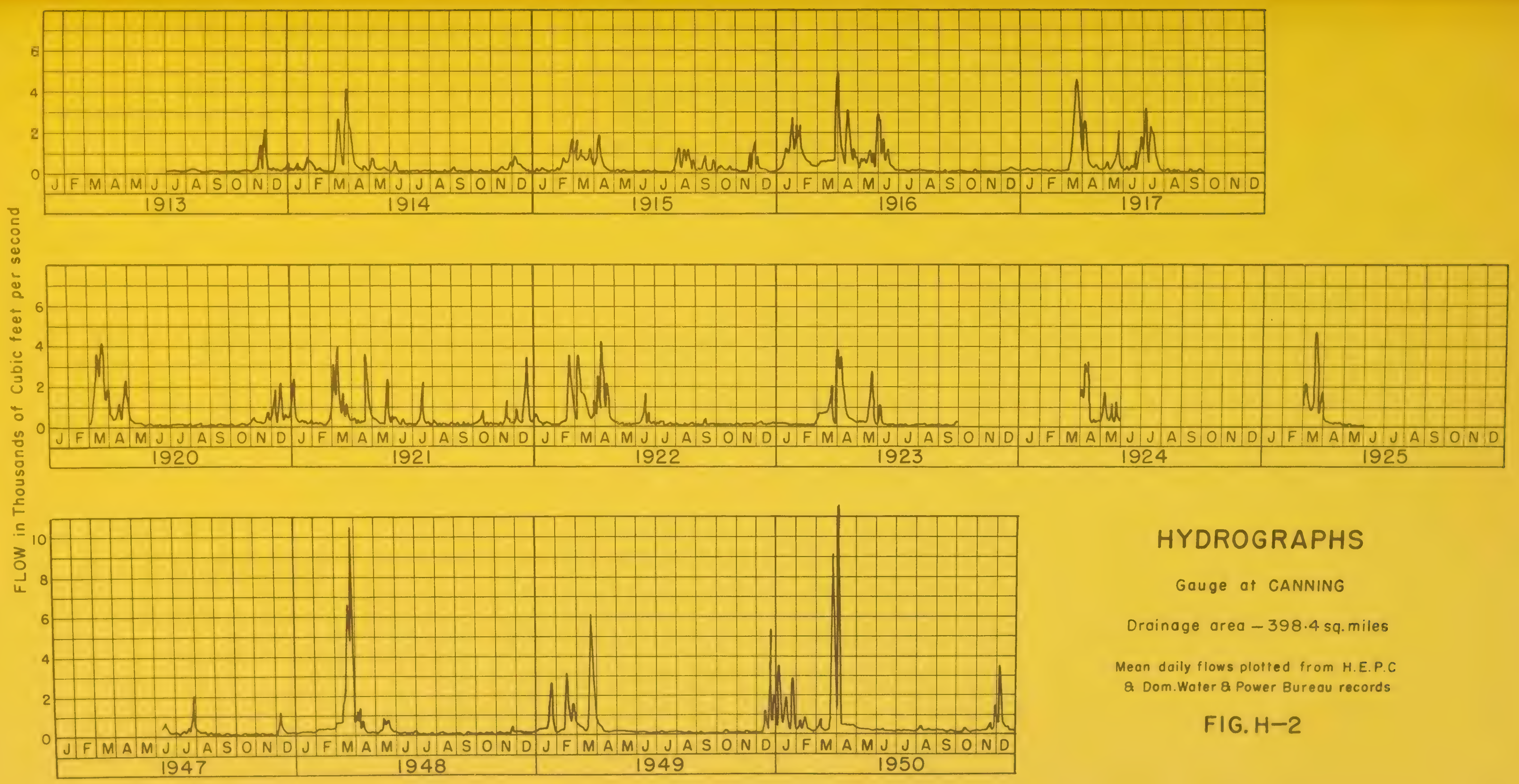
Lower: River in the upper reaches of the watershed. Many of the headwater streams are intermittent and are reduced to stagnant pools of muddy water during the summer months.

are intermittent and short, they are invaluable in determining the rate and volume of run-off from the watershed. There are fifteen years of flow records for Canning gauge covering the periods 1913 to 1917, 1920 to 1925 and from 1947 to the present. (Fig. H-2).

After the amount of run-off has been measured by whichever means are available to the engineer, it will give him a figure of flow which will indicate how much of this water will have to be held back by different methods in order to give the necessary protection where flooding is taking place. This means that a reconnaissance survey of the whole watershed must be made in order that suitable valleys be selected where dams can be built for the storing of the required amount of water. When more than a sufficient number of such reservoir sites have been selected, each must be measured as to its capacity, and the required number chosen to hold back sufficient water to solve the flood problem. In addition, wherever a dam is to be built, some sub-surface exploratory work must be done at the site to make certain that the dam will have a proper foundation. Only after this preliminary work has been carried out can the reservoirs be chosen, the actual designing of the dam structures undertaken, and the work carried through to completion.

While conservation reservoirs are usually built for the purpose of preventing floods, they are needed just as much in Southern Ontario for increasing summer flow. This has become increasingly important in recent years because rivers with extreme low flow and those which dry up entirely are a health menace to the communities through which they pass. Summer flow is necessary for flushing out the channel; to furnish water for industrial plants; for the practice of good agriculture; and is absolutely necessary for dilution where urban municipalities empty the effluent of their sewage disposal plants or raw sewage into the river.

The building of dams for the prevention of



HYDROGRAPHS

Gauge at CANNING

Drainage area — 398·4 sq. miles

Mean daily flows plotted from H.E.P.C & Dom. Water & Power Bureau records

FIG. H—2

flooding and the increasing of summer flow is a comparatively new concept in engineering. It is only within recent years that structures of this kind have been used for this purpose. The older methods included such projects as straightening and widening the river channel and removing obstructions such as islands in the river, narrow bridges and other man-made works which might obstruct the flow or cause ice jams. Also, occasionally, for such work a river was diverted into another watershed, or dikes were built to hold it within its banks. Such practices are aimed at one thing only - to get rid of water as quickly as possible. They do not take into consideration the necessity of holding water at the headwaters for deep infiltration or retaining it for summer flow throughout the year. On some rivers in Ontario channel improvements, diversions and even dikes must be carried out and built, especially where dams and reservoirs are not economical and summer flow is not a major problem.

CHAPTER 2

HYDRAULICS ON THE NITH

1. The Overall Plan for the Grand Watershed

The hydraulics of the Nith River is an integral part of a report which is in progress for the whole of the Grand Watershed. But for expedient measures now recommended at New Hamburg there would have been no hydraulic report for the Nith at this time. It is therefore brief and tentative and a more comprehensive report will be included later in the report on the Grand Watershed.

In the overall plan for the Grand Watershed there is a planned for or "hypothetical" flood which in magnitude is 1 1/3 times greater than that of the spring of 1947, the greatest flood in 37 years of record and probably the greatest since the early days of settlement. It also provides for an increased flow in the Grand River and its tributaries.

2. Stream Flow

A hydrometric gauge for recording daily stream flows has been established on the Nith River at Canning (Fig. H-2) and intermittent flow records covering the period 1913 to the present are available. A study of these records indicates that the mean annual flows vary from a minimum of 289 c.f.s.[1] for 1922-23 to a maximum of 567 c.f.s. for 1915-16, the average annual flow for the period of records being 390 c.f.s.

Maximum mean daily flows usually occur in the latter part of March or early April and have varied from 1,903 c.f.s. in 1915 to 11,600 c.f.s. in 1950. Although the majority of high flows have occurred in March the highest mean daily flow on record occurred on April 5, 1950. This flow caused the second flood along the river within a week. On March 29, 1950, the river reached a mean daily flow of 9,160 c.f.s. and most of the winter's accumulation of snow and ice melted and ran off at this time. The second flood flow of April 5

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1. c.f.s. - cubic feet per second.

was due chiefly to the heavy rains which lasted for several days. Had these rains occurred prior to March 29, on top of the snow and ice pack, the resultant flow would have been much higher than either of the above.

The second highest mean daily flow on record is that of March 21, 1948, when the river reached a flow stage of 10,500 c.f.s.

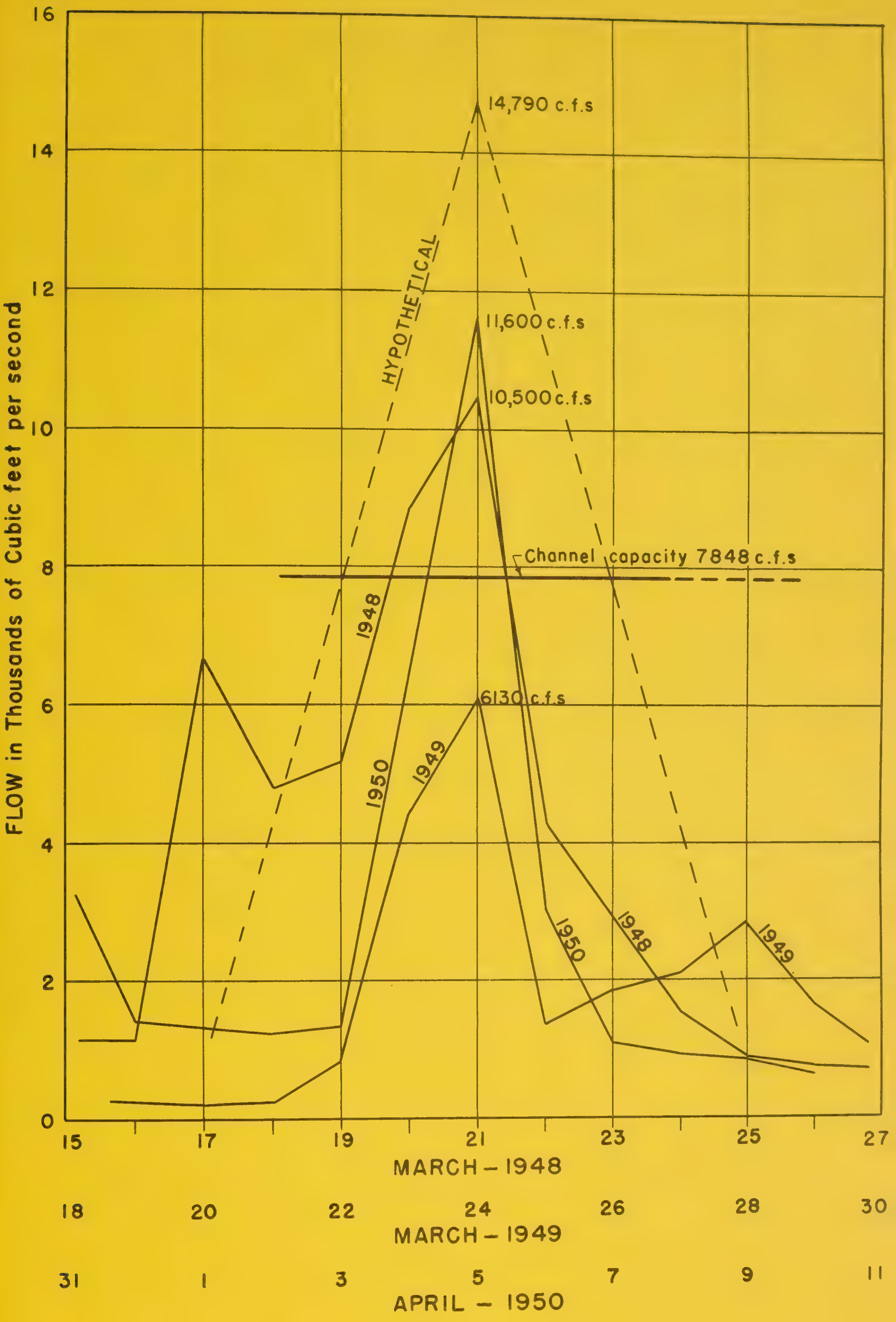
The probable peak flows for the above mean daily flows would be:

Date	Maximum Mean Daily Flow - c.f.s.	Peak Flow c.f.s.
1915	1,903	2,535[1]
March 21, 1948	10,500	13,975[1]
March 29, 1950	9,160	10,010[2]
April 5, 1950	11,600	12,700[2]

Hydrographs at Canning gauge for the 1948, 1949 and 1950 spring floods and the hypothetical flood are shown in Figure H-3.

The lowest mean daily flows generally occurred in the late summer or early autumn. The minimum mean daily flow on record is 16 c.f.s. which occurred on September 12, 1914. The second lowest mean daily flow is that of September 12, 1948, when the flow dropped to 20 c.f.s. For the years of record the lowest month of the year has been September for five years, August for three years, and February, June and July each for one year.

1. Probable peak flows based on Fuller's formula.
2. Actual recorded peak flows from automatic gauge charts.



HYDROGRAPHS

Gauge at CANNING – Drainage area 398·4 sq. miles

Mean daily flows plotted from Dep't. of Resources & Development Water Resources Division records

FIG. H–3

A brief summary of the river discharges at Canning is given below:

Year	Max. Mean Daily Flow - c.f.s.	Min. Mean Daily Flow - c.f.s.	Mean Flow c.f.s.
1913-14	4,080	16	315
1914-15	1,903	50	369
1915-16	4,900	57	567
1916-17	4,710	36	408
1920-21	3,970	54	412
1921-22	3,650	63	411
1922-23	3,890	44	289
April 1924	3,230	312	945
May 1924	1,720	176	615
March 1925	4,750	510	1135
April 1925	468	110	188
May 1925	110	69	84
1947-48	10,500	45	387
1948-49	6,130	20	297
1949-50	11,600	60	443

Records show that all rivers are subject to seasonal variations in flow, but the extreme flows on the Nith present a serious problem. There are floods in the spring, while during the summer and early fall the river falls to a stage where the flow is inadequate for dilution of sewage and industrial waste being added to the river throughout its length. With this condition further aggravated by the high summer temperatures the river becomes foul and presents a serious health menace to those living along its banks.

The causes that give rise to these fluctuations in stream flow may be summed up into two groups: physical and human. The influence of the former is the more important. This is verified by the fact that floods were known to have occurred when the valley was only sparsely settled. However, the human factors have accentuated the effects of the physical factors. Among the physical factors, climate, topography and river gradient are the more important, while on the human side deforestation and artificial drainage are the chief ones. All these factors combine to cause the extremes in seasonal fluctuations.

3. Flooded Areas

The Nith Watershed is the largest of any of the tributaries of the Grand River, having an area of 432.15 square miles. It has not as great a volume or rate of run-off[1] as the upper Grand and Conestogo Rivers, but it is high in both volume and rate during flood periods and causes severe flood damage along its course. The principal places that are flooded are New Hamburg, Plattsville and Ayr. The Nith is also a contributing factor to damaging floods at Paris, located at its confluence with the Grand River, and to other municipalities down stream.

4. Storage

Of the various measures for controlling the high damaging spring flows, the use of storage reservoirs is superior to the other methods. In addition to reducing the high spring flows to a safe stage they may be used to conserve water supplies and to regulate stream flows, holding over excess water from wet periods for release during times of deficient flow.

It has been estimated that approximately 40,000 acre feet of storage is required on the Nith Watershed. This amount of storage would, except in the cases noted below, provide protection against floods up to the magnitude of the hypothetical flood for all the municipalities along the river. It would also supply an adequate increased flow throughout the balance of the year and ensure a safe dependable supply for all who would use the river.

5. Reservoirs

A reconnaissance survey of several reservoir sites on the Nith River has been made. Two have been chosen, Nithburg and Ayr reservoirs, shown on Figure H-4. They are

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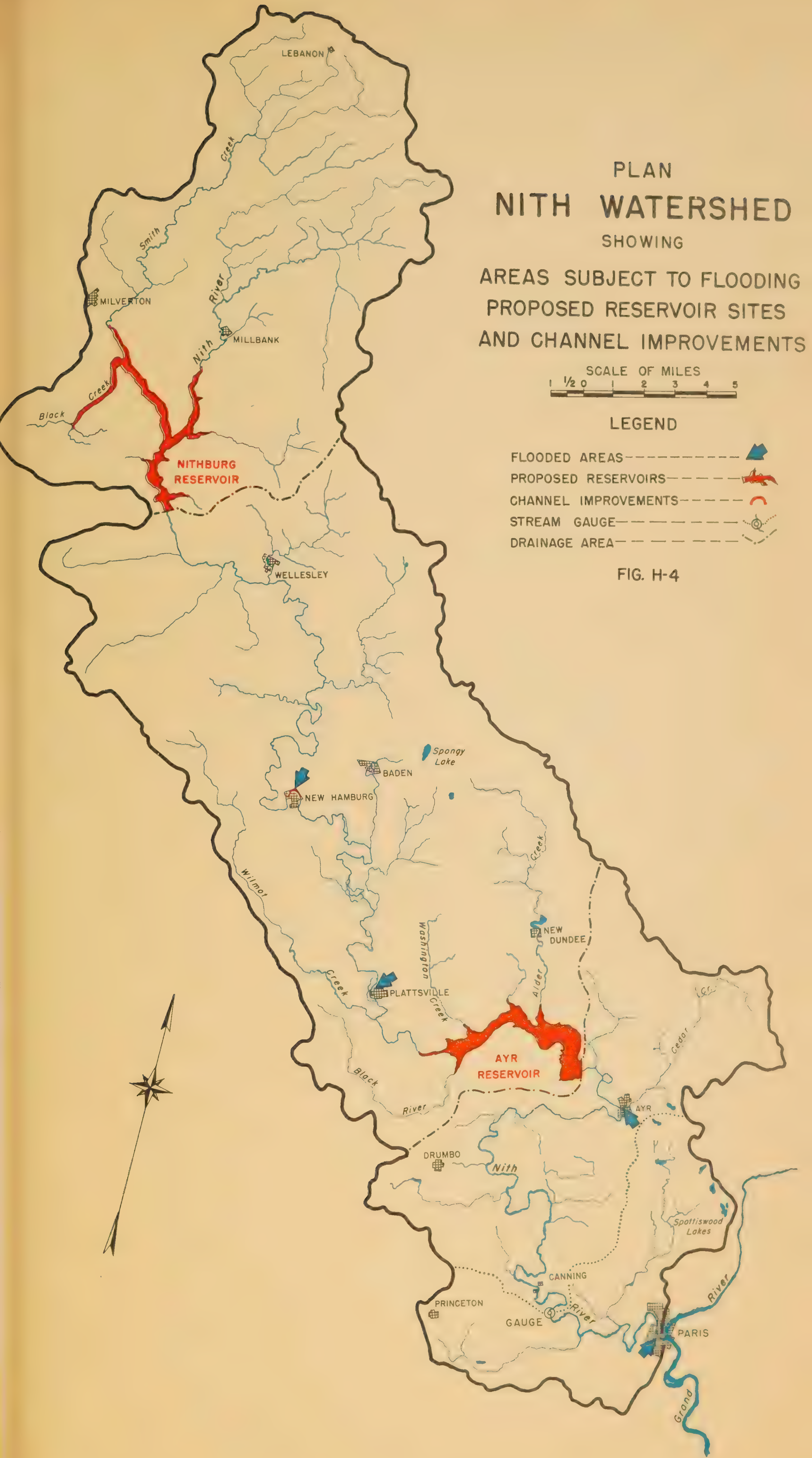
1. Run-off is the overland or surface flow plus the ground-water flow which reaches any rivulet, stream, tributary, river or lake.


PLAN
NITH WATERSHED
SHOWING
AREAS SUBJECT TO FLOODING
PROPOSED RESERVOIR SITES
AND CHANNEL IMPROVEMENTS
SCALE OF MILES
1 1/2 0 1 2 3 4 5
LEGEND
FLOODED AREAS
PROPOSED RESERVOIRS
CHANNEL IMPROVEMENTS
STREAM GAUGE
DRAINAGE AREA
LEBANON
Creek
Smith
MILVERTON
River
Nith
MILLBANK
Creek
Black
NITHBURG RESERVOIR
WELLESLEY
Spongy Lake
BADEN
NEW HAMBURG
Creek
Wilmot
NEW DUNDEE
Washington
Creek
PLATTSVILLE
Alder
Creek
AYR RESERVOIR
Cedar
Black
River
AYR
DRUMBO
Nith
Spottiswood Lakes
CANNING
PRINCETON
GAUGE
River
PARIS
River
Grand
FIG. H-4

fairly well located strategically and together have the required storage capacity.

The uncontrolled area between the proposed Nithburg Dam and New Hamburg is too great for complete flood protection in that village. There is another reservoir site within this uncontrolled area above New Hamburg, but the storage capacity is not sufficient and a third reservoir would be necessary. Some channel improvement at New Hamburg (shown below) is therefore proposed to supplement reservoir storage and satisfy the flood problem at New Hamburg. These remarks apply also but to a lesser extent to the village of Plattsville.

The Ayr reservoir will reduce flood crests at Ayr and all places below it to a safe stage and, in conjunction with the other reservoirs in the overall plan, will reduce flood crests to a safe stage at Paris and places downstream on the Grand River, including Brantford and points below.

6. Local Improvements

(a) New Hamburg Channel Improvements (Fig. H-5)

Due to the large uncontrolled area between the Nithburg damsite and New Hamburg and to the fact that this unit will probably not be built for some time to come, other works which will supplement the Nithburg storage reservoir and provide more immediate relief are necessary. The Nithburg site is the first natural site above New Hamburg where the required storage may be found, but there are 83.9 square miles of drainage area between this site and New Hamburg and even with the dam in place the run-off from this area alone could be sufficient to cause flooding at New Hamburg.

By improving the channel through New Hamburg its capacity may be increased so that it will contain a flow of 4,740 c.f.s. without flooding. Any further increase in capacity by channel improvement is limited by the capacity of the channel immediately below New Hamburg. This improvement

PLAN OF
VILLAGE OF NEW HAMBURG
SHOWING
CHANNEL IMPROVEMENTS AND
AREA SUBJECT TO FLOODING

SCALE: 1 in = 200 ft. (Approximate)

200 100 0 200 400 600

FLOODED AREA —

FIG. H-5

alone would contain the flood flows of many years, but would not contain peak flood flows of the magnitude of the 1948 spring flood which was estimated at 7,730 c.f.s. Nor would it contain the flow from the uncontrolled area below the proposed Nithburg site during a flood of the magnitude of the hypothetical flood for which all the flood control works for the whole Grand Watershed will be designed.

Further protection may be provided by raising and extending the present dikes to supplement the above channel improvement work. By this means the channel capacity could be raised to 9,400 c.f.s. which is the maximum discharge capacity of the present East-West Street bridge. This combined work would provide for protection against such floods as have occurred in the past, and as supplementary works to the Nithburg project it would provide the necessary protection to the extent of the hypothetical flood.

The channel improvement provides for an excavated channel about 7,900 feet in length with a bottom width of 100 feet and graded to a uniform slope throughout. The improved channel would follow the general course of the river channel except for a short cut-off channel which leaves the present channel at a point about 200 feet below the East-West Street bridge and connects to it again about 1,600 feet down stream. This cut-off eliminates the sharp bend at that point and shortens the channel by about 300 feet. The convex side of the cut-off channel would be rip-rapped to prevent the river from returning to its former course.

The diking would parallel the right bank of the river and the new channel. Commencing at a point 470 feet north of the Church and Wilmot Street intersection, it would extend to the existing dike at the fairgrounds which would be raised and lengthened to prevent the flood waters from backing up into the village proper. The new dike would have a top width of 8 feet and would include control gates at the head and tail of the millrace.

1947 SPRING FLOOD AT NEW HAMBURG

Upper: House on north edge of village flooded out.

Centre: Corner of Grace and Jacob Streets looking north

Lower: Corner of Grace and Jacob Streets looking east. The water at this point is 700 feet from its normal channel.

Plans showing the location and extent of this scheme have been submitted by the Kilborn Engineering Co. Ltd. of Toronto and their estimated cost as of January 3, 1951, is:

(1)	River channel improvement	$49,500
(2)	Raising and extending dikes	32,000
	Combined total cost	$81,500

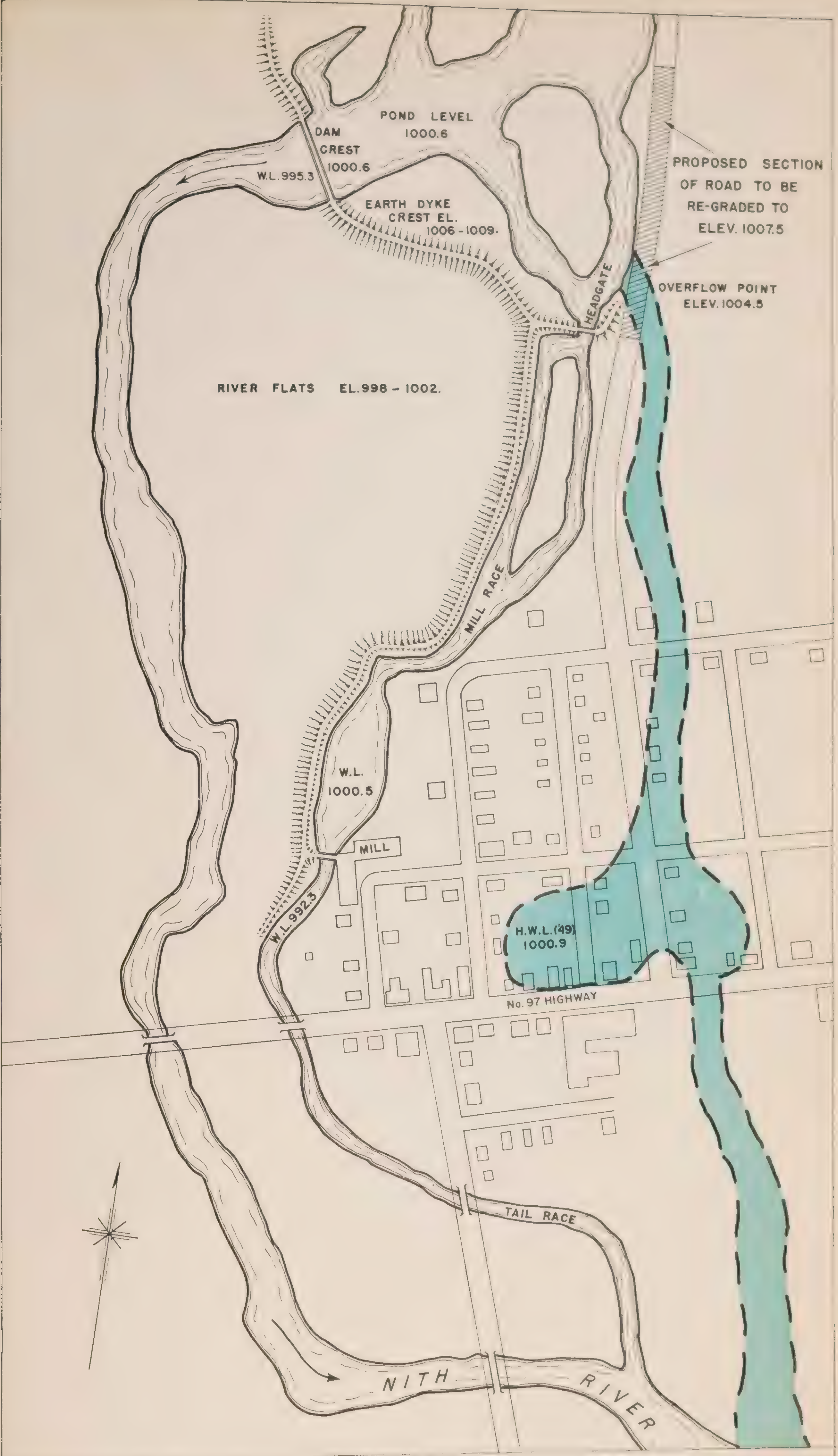
In view of the serious flooding at New Hamburg and of the fact that further work would be required here to supplement the proposed storage above New Hamburg, it is recommended that the combined scheme of channel improvement and diking to increase the channel capacity to 9,400 c.f.s. be implemented.

(b) <u>Plattsville: Improvements (Fig. H-6)</u>

In order to prevent flooding at Plattsville it would be necessary to either reduce the spring flows to the present channel capacity or increase the channel capacity to contain the high flows. The Nithburg Reservoir will reduce the spring flows by about 45 per cent which would prevent flooding for most years. There would be 124 square miles of uncontrolled drainage area above Plattsville, and for years of extremely high flows such as 1947 and 1948 the run-off from this area alone would be sufficient to cause some flooding. Thus, as in the case of New Hamburg, some local work is necessary to provide further protection.

This additional protection may be had most easily by raising a short section of the forced road through Lot 18, Con. XIII north of Plattsville. This would require a 700-foot length of the road being raised a maximum of 3 feet.

Estimated cost for grading and resurfacing this stretch of road with gravel is $3,000.



PLAN OF THE VILLAGE OF

PLATTSVILLE

SHOWING AREA SUBJECT TO FLOODING
AND PROPOSED REMEDIAL MEASURE OF RE-GRADING THE ROAD

SCALE: 200 0 200 400 600 FEET.

FLOODED AREA

FIG. H-6

The fundamental cause of the trouble at this point, however, appears to be the inadequate spillway capacity of the mill dam. Measures to increase this capacity by adding stop-log sections to the dam would provide a more satisfactory solution but at a much higher cost.

CHAPTER 3

PONDS [1]

1. The Value of Farm Ponds

Water supply on farms in Southern Ontario is obtained from wells, streams, springs, ponds and cisterns. With the mechanization of farm operations, the improvements in sanitation and with larger and better herds there is an increased demand for water. Supplies, on the other hand, are diminishing. Shallow wells often get their supply from "perched" water tables which are rapidly disappearing and are not likely to be re-established. Deep wells and some shallow wells draw water from the permanent level of underground water. This, in many regions, has lowered considerably. Streams, springs and ponds are drying up or are being filled in, partly through mismanagement but largely from the gradual change in the physical features of the land which goes along with the change in land use.

Against this increased demand and diminished supply can be balanced one outstanding natural feature, namely, that Southern Ontario receives, on the average, thirty inches or more of rainfall in a year. Although there is often a lack of rainfall in the summer months there is an ample supply in winter and spring. The need therefore is to store some of this spring run-off by proper land use in the earth itself, and thus increase the ground water supply and maintain summer flow in streams and springs.

Farm ponds are directly connected with soil conservation. The study of soil erosion in Southern Ontario reveals that the most important single remedy for arresting this insidious process is the establishing of good sod cover. This

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1. A bulletin on Farm Ponds has been published by the Grand Valley Conservation Authority. The six types of ponds described herein are each illustrated with four photographs and drawings which serve as an aid in building the particular pond required. The bulletin may be obtained on application to the Secretary of the Authority, Mr. W. R. Arundell, 27 Dickson Street, Galt, Ontario.

in turn would provide a considerable increase of grazing land. One of the biggest obstacles to establishing improved pasture on eroding land is the lack of watering places for herds. Properly managed springs, streams and natural ponds give the cheapest and most reliable supply of water. Small ponds offer the best form of management and provide reservoirs in time of drought.

The hazard of fire is becoming increasingly important with higher costs of buildings and equipment. Much is being done for fire protection by better organization and equipment, but fire-fighting apparatus requires ample supplies of water from which it can draw. Wells, in many instances, are inadequate for pumps. Natural supplies are not dependable and often remote from buildings. Therefore well built ponds, favourably located, are much better sources for this purpose.

Many farmers know that good facilities for recreation are necessary to make farm life attractive to hired help and to their own children. Water, especially for swimming and skating, fishing and boating, can be the focus of recreational activities. There is increasing interest in ponds for this purpose.

Conservation aims at the creation of a balance between all living things, including wildlife population such as muskrats for commercial exploitation, game for hunting, fish for angling and certain species of birds and mammals for the control of pests. These purposes can be served by farm ponds or by well managed natural streams, and in some instances they may be suitable for a combination of uses.

Recent spells of drought have created interest in irrigation. Ponds can serve a useful purpose in this regard, either by preservation of pasture or protecting a valuable cash crop. For example, a half-acre pond of average depth of 4 feet contains 24 "acre-inches" of water, enough to cover a 12-acre field with 2 inches of water. Throughout much of South Central Ontario there were in 1949 four weeks during June and

July in which there was no rainfall at all in a period in which at least two inches could be expected as the average fall. Conveniently located, a pond of the above size could be used to take up this slack.

It is generally believed that any measures to hold water on the land would improve ground water levels and summer flow in streams as well as mitigate flood conditions on rivers. It would take a good many ponds to effect a measurable improvement in this regard, but in view of the many other advantages in controlling surface flow of water it is not too much to hope that small ponds might become numerous enough to improve the whole situation materially.

2. Types of Farm Ponds

(a) The Dug-Out Pond

The dug-out pond is built in a depressional area and receives its water supply from the ground water down to which it is dug. It is the cheapest pond for a farmer to build and is well adapted to pasture land providing the correct site can be found. However, unlike ponds which receive their water supply from springs or creeks, the dug-out pond tends to become stagnant in late summer.

Ground water levels (called the water table) change throughout the year, and late in the summer season may go below the bottom of the dug-out. There is little or nothing which may be done locally to raise the water table, and this type of pond is dependable only in spots known to stay wet all summer.

In certain types of hilly country with irregular slopes and hollows, there are natural waterholes called "kettle" ponds. In many instances these have filled in but can be cleaned out to re-establish ponds. These may sometimes be refilled during the summer by rain running off the slopes around the pond, but in the climate of Southern Ontario this is not common enough to be a dependable source of water.

(b) <u>The Spring-Fed Pond</u>

The water supply for this type of pond is derived from a spring, usually up the slope or "draw" from where the pond is situated, and because of its location - that is, in the lower part of a small storage basin - it must be protected from damage and excessive flooding by a grassed waterway or emergency spillway by which the surface run-off is deflected around the pond.

Spring water is rainfall which has been stored in the ground and seeps gradually through the soil until it is discharged at a spring. The supply may be that which falls locally on land above the spring, especially if it is light soil; on the other hand some springs get their water from strata of sand and gravel which carry it great distances and the original source may not be known.

(c) <u>The By-Pass Pond</u>

A pond of this class is built close to, but not on, a permanent stream and gets its name from the fact that the water supply is by-passed through a pipe from the stream to the pond. This type has the advantage over some others in that there is no danger of the pond filling up with silt, because any excessive run-off goes down the permanent stream channel and not through the pond. Moreover, the water in the pond can be kept reasonably clean because the supply can be shut off when the stream becomes turbid. This is an inexpensive pond to build and should be attractive to a farmer who has a small permanent creek on his property.

Permanent streams get their water from a number of sources. During the spring thaw or rain, when the soil is saturated, the source is mostly surface run-off or overland flow. Springs are often the first source of streams, especially those that rise in gravelly hills or from limestone bluffs. During drought, stream flow may be maintained by the ground water, the level of which gradually lowers. The ground water

may be recharged during autumn and spring. To get as much moisture as possible into the soil and into the ground water, soil conditions and vegetative cover must be favourable. The same practices which help to conserve soil help to conserve water, namely good organic content of soil, contour tillage on long smooth slopes, good sod, and forest cover on steep land and coarse or shallow soils.

(d) <u>The Run-Off Pond</u>

Such a pond gets its name from the fact that the water supply is obtained by the natural percolation and surface run-off which accumulates at the lower elevations of a small drainage basin where the dam is built. The success of such ponds during the summer depends entirely on the amount of rainfall which occurs at that time. The vegetation of the slopes also is an important factor. If the slopes are mostly woodland or permanent pasture or a combination of both, the supply will be more even. If the slopes are cultivated fields there will be danger from too rapid run-off and silting unless these are cultivated on the contour or strip-cropped.

Many run-off ponds can be seen in the Northern United States, where they are very successful. In the State of Ohio, and particularly in the Muskingum region, this type of pond has been developed to advantage. However, in this connection it must be remembered that the annual rainfall in Ohio is usually 40 inches, whereas in Southern Ontario the average rainfall is close to 32 inches. This extra 8 inches of rainfall in Ohio usually occurs during the summer months. In the summer of 1949 certain parts of Southern Ontario received only 8 inches of rain from May until September, when an average of 14 inches can be expected. It must also be noted that in Ohio, summer storms with great intensity of rainfall and, consequently surface run-off are common but they are rare in Ontario. Actually there are many summers in Ontario when there is no surface run-off.

While examples of this type of pond can be found in Ontario, and while under favourable conditions such ponds retain water throughout the summer, it is most likely that in years of drought they will dry up. Consequently this report emphasizes the building of other types of ponds recommended herein, until more knowledge is obtained regarding the successful building of run-off ponds.

Ponds of the run-off type can only be considered on watersheds greater than 40 or 50 acres on which there is some permanent supply of water, but not on watersheds greater than 150 acres because maximum flows are too great to be handled by earth spillways.

The term run-off is used in measuring the flow in a stream. There are actually two main sources: "surface run-off" or overland flow of water; and "percolation run-off", that is, the water that travels through the soil to reach a stream. Although surface run-off may be very great in extreme instances in the summer, it is not a reliable source of water except during spring thaw or late spring rains.

(e) <u>The Permanent Stream Pond</u>

This type of pond is built in the channel of a small permanent stream by erecting a concrete or earth dam or a combination of both across the stream, thus forming a reservoir or pond behind the dam. Such structures require care in planning and if the stream is a large one and the pond is to be of considerable size it will be to the advantage of the owner to secure expert advice, as such structures may run into considerable sums of money. Moreover, under the Statutes of the Province of Ontario it is unlawful to dam a permanent stream without first securing permission from the Surveyor-General, which means that a plan must be filed in his office. The same principles of construction, however, apply to small dams, and where the stream is small the building of such a pond should be

within the reach of the average farmer.

Adequate summer flow on permanent streams can hardly be ensured by one property holder, as it depends on the conditions of the whole watershed, which may be thousands of acres. In choosing a site for a dam on a permanent stream, consideration must be given to the conditions over the whole watershed of the stream above that point.

(f) The Temporary Pond

The temporary pond is formed by building a temporary dam of wood, or wood and steel, across a permanent stream and is removed in the fall to allow the spring freshets to come down. Such dams are used on streams which have excessive run-off in the spring but a comparatively small flow in summer. They are a means of building a summer pond where the cost of a permanent dam large enough to withstand the buffeting of spring freshets would be too expensive.

3. Purpose and Method of the Survey

A survey of all existing ponds on the Nith Watershed was made to compile all the known facts about construction, use and management of successful ponds, to find out the causes of failure in unsuccessful ponds and to determine those areas in which pond construction could be recommended.

The locations of all existing ponds were determined by examination of aerial photographs, by questioning local residents and by following all streams on foot. Each pond was visited and examined. A description of the dam and pond and of the stream, spring or watershed feeding it was made. Particulars of its use were learned from the owner. Features of mismanagement or causes of failure were also noted.

4. Ponds on the Nith Watershed

(a) Dug-Out Ponds

Only two dug-out ponds were found on the watershed. Both are simple structures built at no great cost and

used for reservoirs of water for fire protection. The soil material where these have been built is clay or clay loam and the ponds have been excavated to an impervious layer which will hold water. Both are sustained by ground water and one has surface run-off from about 3½ acres added to it. Each has a maximum depth of four feet and is about forty yards long. One is used for fire protection of a cheese factory near Wellesley. The other is on a farm, and as it is fed partly by surface run-off its capacity may be enlarged by damming one end.

(b) Spring-Fed Ponds

Seven ponds of this class were found on the watershed. A good example of a spring-fed pond is situated on a farm east of Plattsville and is used for watering stock. Overflow is led into a watering trough but as the run-off from about twelve acres flows into the pond the dam is in danger of being washed out. This is an example of a situation where a diversion ditch above the pond would protect it. Although the pond is adequate for the farmer's present needs, a little improvement would make this a good demonstration of a spring-fed pond.

Five of the spring-fed ponds are used for fish or are being stocked. An excellent example is on a farm north-west of Wellesley Village (Lot 10, Concession III of Wellesley Township), where a hydraulic ram provides a domestic water supply and the overflow fills a beautifully shaded trout pond. The spring, which issues from a steep gravel ridge, has been carefully boxed. Both spring and pond are protected from cattle.

On a farm north-east of Bamberg there is a spring-fed pond of unusual charm and beauty which shows good management and use. The pond was formed by excavating a mucky spot where some springs provide the source of a small stream. A small earth dam holds the water. Overflow of cool spring water is used for cooling in a milk house.

A small pond near the village of Washington illustrates the possibilities of a good pond site but at the time of

A dug-out pond used for fire protection.

A spring-fed pond with hydraulic ram for domestic water supply. It is also used for fish.

The temporary check dam on a permanent stream, which diverts water into a by-pass pond.

the survey it had not been developed to the best advantage. The spillway to carry overflow has not been adequate and there is a gap in the earth dam. The presence of muskrats suggests another use of ponds of this type.

(c) By-Pass Ponds

Three ponds of this type were found. A very good example may be seen near Wilmot Centre. A spring-fed stream flowing from the Baden Hills is checked by a small wooden dam and diverted into an excavation at the side of the stream. The pond has a depth of $4\frac{1}{2}$ feet and is about 60 by 90 feet in area. Water seeps through a filter trench to a shallow well from which it is drawn to the barn. It has already proven its worth in putting out a fire.

A pond on Lot 11, Concession II of Wellesley, illustrates some of the difficulties in making a pond of this type. There is seepage loss through the dam and the bottom of the pond does not appear impermeable. This pond was built primarily for fire protection and an attempt is being made to use it for fish.

(d) Run-Off Ponds

Some of the existing ponds receive water from surface run-off in addition to ground water, stream flow or springs. There are, however, no ponds on the watershed which are fed entirely by surface run-off. An example of this type of pond may be seen on Midway Farm near Brantford (outside the watershed). This pond is filled in the spring of the year by the melted snow from about 220 acres and once in four years it has been reported to have been recharged by surface run-off during a "cloudburst".

The site of the pond was excavated. An earth dam, with concrete spillway section, holds back the water. The watercourse leading to the pond has been channelized. The pond area, and the watercourse for some distance up from the pond, are fenced. The land on this farm is quite subject to erosion,

being hilly, with slopes up to 22 per cent. The pond is protected from silting and the soil against erosion by a sod grown from good pasture mixtures and very well managed. The animals grazing on this farm are watered at troughs to which water is pumped by a windmill from the pond. In this splendid example of a conservation project the pond and the land use are well suited to each other.

(e) Dams on Permanent Streams

Some of these in the area are quite elaborate and costly structures which can hardly be considered as farm ponds, but in so far as they serve some agricultural purpose and because they point up valuable lessons in pond-building they were studied in this survey.

A "farm pond" might be defined as a surface reservoir of water, the cost of which a farmer would be prepared to meet for a supplementary supply of water, or as his main supply if an adequate well is not available. Many dams on permanent streams do not fall within this definition but the conditions, methods of construction and management are essentially the same.

Some ponds are built by excavating in a stream bed or by putting an earth or concrete dam right across a stream. These methods will produce reservoirs of water but are very likely to fail for two reasons. First, heavy flows in spring may wash out an earth dam or wash around a concrete one. Secondly, sediment carried by the stream may fill the reservoir in a few years. An example of this silting-in of a pond can be seen on a farm about a mile and a quarter southwest of Doon. Changing this pond to a by-pass type would eliminate the disadvantage of silting.

Five typical farm ponds of this type on the watershed were filled with water from drainage areas ranging from 650 to 850 acres. There is no proof that such large areas are necessary and the safe handling of large amounts of water creates a problem.

On Lot 38, Concession II of South Dumfries, there is an earth dam with spillway section, holding water in a pond which is now barely two feet at its deepest but which was formerly more than four feet deep. The spillway is 35 inches high and 36 inches wide but this is not big enough. Upstream there is a culvert with opening 70 by 42 inches which can carry the maximum flow. The land drained by the stream is about 850 acres. When the spillway section is only a notch in the dam, that is, does not extend downwards to the bottom of the dam, the pond can fill with silt up to the bottom of the spillway. This dam was built to develop power but is now used for watering stock and is available for firefighting.

Near Wilmot Centre there is a good example of a dam on a permanent stream with a well-kept pond. It was originally built for power but is now used for fishing. The owner proposes to renovate the pond for fish and fire protection. The dam is 12 feet high, 6 feet wide at the top and 60 feet long. A spillway of 38 inches in diameter has, so far, proven adequate to carry the greatest flow from drainage of 718 acres. The dam has boulder rip-rap on the wet side to protect it against burrowing by muskrats.

A pond near Bamberg is used for a swimming hole which was originally built for a sawmill. The spillway has always proved adequate and stop logs are taken out to clean out the pond.

The remaining ponds formed by dams on permanent streams are primarily for developing power with incidental use for recreation, fishing and fire protection. The streams drain areas of from 700 to 12,000 acres and each dam has to provide spillway capacity for flood flows from these large areas. These ponds are found at Ayr, New Dundee, Baden and Wilmot Centre.

Comparisons of spillway capacity to drainage area of streams in each instance can be a guide in the construction of smaller ponds for farm use. Where there are no

dams now in existence the measured flow of water through culverts can also give a clue to the size of spillway necessary in permanent dams. Twelve dams on permanent streams were visited on the survey.

(f) Temporary Ponds

There are examples of this type of pond in other parts of the province used for various purposes, chiefly recreational, but none was observed in the Nith Watershed.

5. Use and Distribution of Ponds

Almost every kind of use was made of the ponds surveyed and many had more than one use.

From the conservation point of view emphasis might be put on two uses - stock-watering to permit use of land for grazing, and the general purpose of conserving water. Four were used primarily for fire protection and there was a great deal of interest expressed by local people in this phase of pond use.

Fire equipment, in many instances, can pump much faster than wells can supply water. Also wells or cisterns are often within, or close to, farm buildings so that they are not accessible to firefighters. A pond of only one-quarter acre in extent with an average depth of four feet contains enough water to supply a fire pump, at the rate of 420 gallons per minute, for hours[1].

Eight of the dams were constructed for water power supply and two for electric power. Some, although they are still used for that purpose, now serve other uses, including recreation or as a water supply for firefighting.

Some ponds were developed for fish, usually those with a supply of cold water which could support trout. More might be done to exploit ponds for other types of fish, such as bass, which tolerate warmer water.

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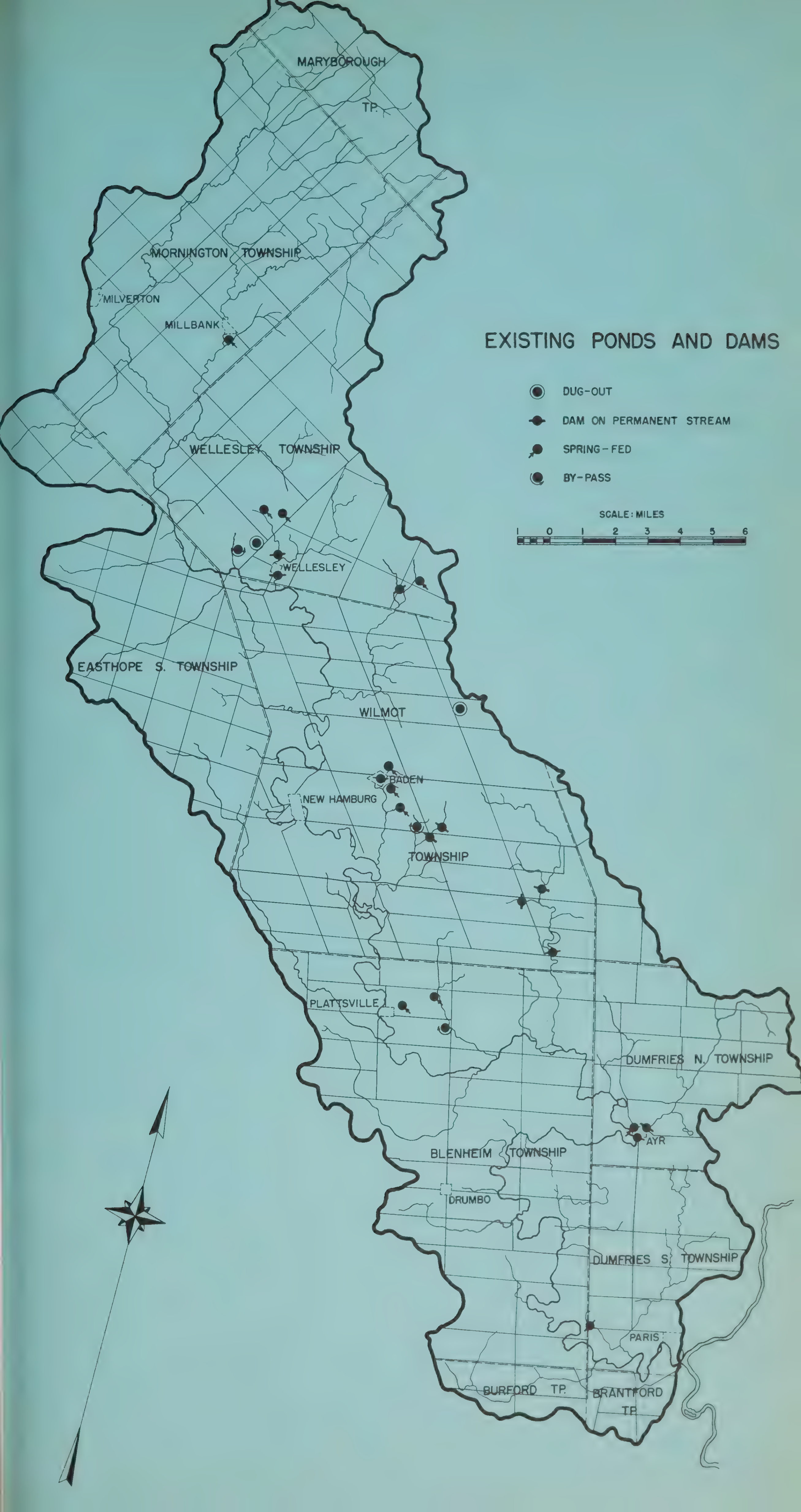
1. One quarter-acre of pond four feet deep contains one acre-foot or 271,472 gallons. The equipment in a village fire brigade may pump at 420 gallons per minute under 120 pounds pressure.



EXISTING PONDS AND DAMS
DUG-OUT
DAM ON PERMANENT STREAM
SPRING-FED
BY-PASS
SCALE: MILES
1 0 1 2 3 4 5 6
MARYBOROUGH TP.
MORNINGTON TOWNSHIP
MILVERTON
MILLBANK
WELLESLEY TOWNSHIP
WELLESLEY
EASTHOPE S. TOWNSHIP
WILMOT TOWNSHIP
BADEN
NEW HAMBURG
PLATTSVILLE
DUMFRIES N. TOWNSHIP
AYR
BLENHEIM TOWNSHIP
DRUMBO
DUMFRIES S. TOWNSHIP
PARIS
BURFORD TP.
BRANTFORD TP.

No evidence was found of use of a pond for irrigation. Experience elsewhere in Ontario and in those parts of the United States with geographic conditions similar to those in Ontario shows the great possibilities of this use, not only for specialized crops but for field crops and pasture, especially during the emergency of a drought. The water used for this purpose is that which was impounded during heavy flow with a surplus of water. Most ponds could be put to wider use than the present uses by a little planning and improvisation. All ponds found in the survey were put to more than one use. Domestic fowl, and water supply for a steam boiler were two special uses found.

The location of existing ponds, according to type, is shown on a map of the watershed. This map was compared to a physiographic, or generalized soil, map of the watershed. The distribution of ponds according to soil material was as follows.

No ponds were found within areas of the sandy and gravelly Waterloo and Dumfries soil series. These are on the rough sandy and gravelly hills called moraines. The soil material is too permeable to hold water. There are a few natural ponds in these formations in the hollows but there are not even well established surface streams. These areas show up on the topographic map by the following features: steep and irregular slopes (indicated by irregular but closely spaced contour lines), numerous natural ponds and marshes, and no permanent streams.

The greatest concentration of ponds - spring-fed, by-pass, and ponds in permanent streams - is found around the margins of the moraines where the permeable Waterloo and Dumfries soils touch the less permeable soils of the Guelph and Huron series.

Although one might expect numerous ponds in the stream valleys very few are found except the old large structures built for water power. This may be partly because there

is no urgent need for ponds where streams give fairly consistent supplies. It is also due to the difficulty of holding water where dykes, dams and bottoms consist of coarse-textured, permeable silty and gravelly soils (which are identified as bottom land or as belonging to the Burford soils or their associates).

Ponds of all types are found in the areas covered by the loamy Guelph soils and the clayey Huron soils and their associated series. Dug-out ponds fed by ground water are found particularly in the Perth and Brookston clay soils. (These are the imperfectly and poorly drained associates of the Huron series.)

6. <u>Recommended Pond Regions</u>

Pond locations might be recommended for three different reasons; first, their need in water conservation or in a soil conservation program; second, their need to supplement, or take the place of, wells in areas short of water; and third, the suitability of soil and surface relief for pond building.

The need for ponds for water conservation is pretty much the same over the whole watershed, as summer dry spells and greatly reduced summer flow of streams are common conditions. Ponds for stock-watering are an integral part of any soil conservation program because the maintenance of good pasture on erodible soils is an important feature of conservation.

There is not an acute shortage of ground water on the watershed generally and ponds for water supply can be considered as supplementary or for special uses such as fire protection, fishing, recreation or irrigation. These needs are general throughout the area.

Some areas are more suitable, because of soil or favourable relief, than others. Also different types of pond are especially suitable for different types of land.

The accompanying map of Recommended Pond Regions was developed from soil maps compiled from material kindly made available by the Ontario Soil Survey, Ontario Agricultural College, Guelph, and from the distribution of existing ponds. Five types of land are designated as follows:

(a) Suitable for all types

This includes areas of the two main groups of soils, the medium-textured, loamy soils of the Guelph, London and Parkhill series and the clay soils of the Huron, Perth and Brookston series. Where the water table is high dug-out ponds can be constructed. Springs are not uncommon and spring-fed ponds can be constructed. On permanent streamsdams may be constructed if the drainage area is not too big or, preferably, by-pass ponds can be built. Ponds filled entirely by surface run-off might be built on watercourses with intermittent flow. None of this type was found on the Nith Watershed but the one filled annually by spring freshets, which is herein described, merits further study and imitation.

(b) Less suitable for ponds

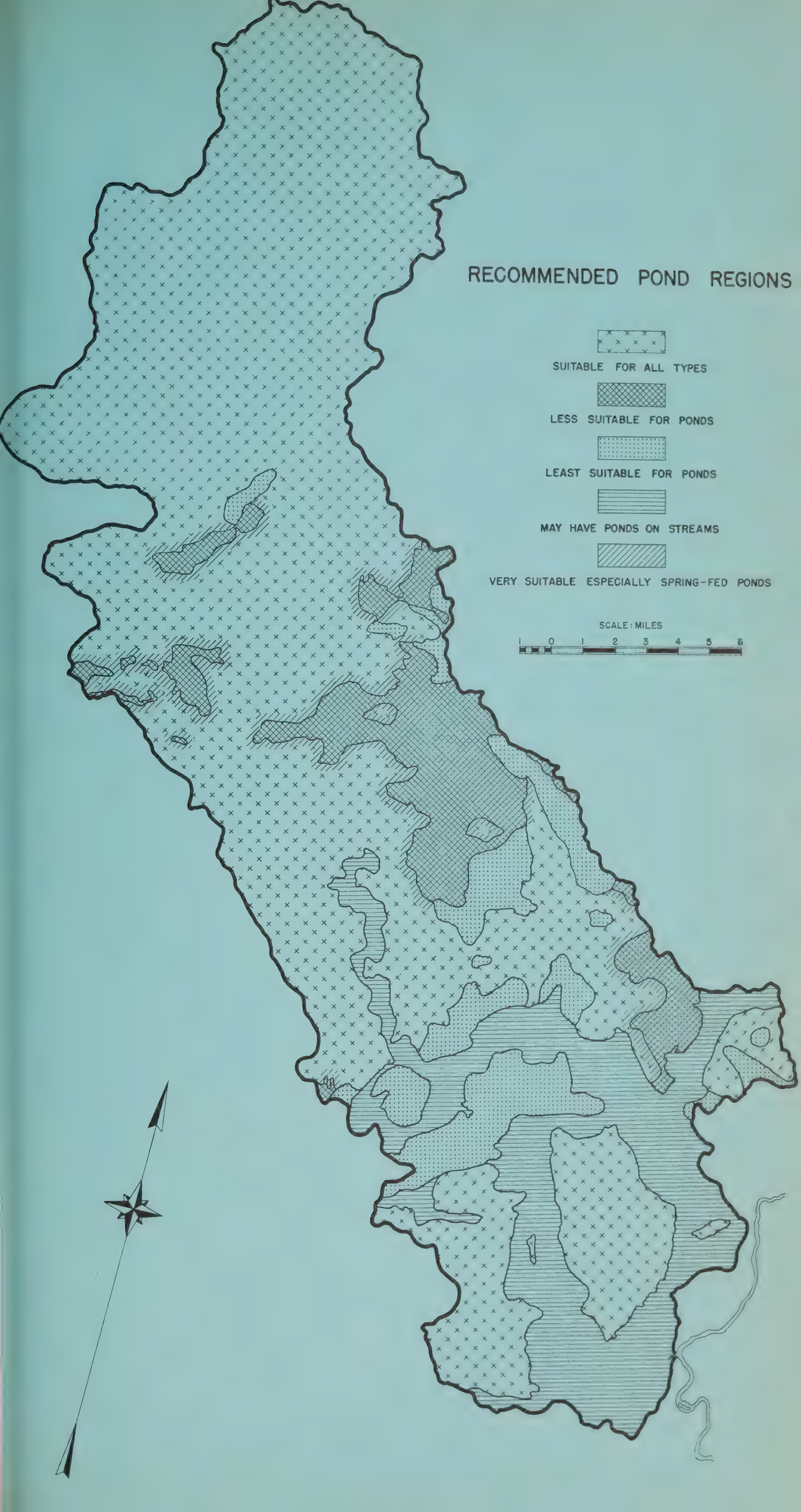
These areas are occupied by the moraines, sandy and gravelly soils which will not hold water. Only in hollows where marshes and swamps are found dug-out ponds, spring-fed ponds or run-off ponds might be built.

(c) Least suitable for ponds

Soils of the Dumfries series have a very coarse texture and loose structure and do not hold water. In so far as no artificial ponds and very few natural ponds are found within areas of this soil they are considered least suitable for ponds.

(d) May have ponds on streams

Broad, flat areas of silty and gravelly soils in the valleys on the lower reaches of the river are less suitable for ponds because of the permeable nature of the soil. Where an impermeable clay layer may be found and where stream



RECOMMENDED POND REGIONS
SUITABLE FOR ALL TYPES
LESS SUITABLE FOR PONDS
LEAST SUITABLE FOR PONDS
MAY HAVE PONDS ON STREAMS
VERY SUITABLE ESPECIALLY SPRING-FED PONDS
SCALE: MILES
1 0 1 2 3 4 5 6

water is available small reservoirs could be built. These lands are largely covered with scrub or forest and their future use is likely to be for forestry or wildlife. Ponds for fish or for protection of plantations against fire might be required.

Narrow areas of similar soils along river bottoms are found throughout the watershed but are too small to be shown on the map in this report. Operators are cautioned against attempting to construct ponds on such soils until borings show an impermeable soil within a reasonable depth.

(e) Very suitable, especially spring-fed ponds

Reference to the topographic map shows areas in which many streams have their sources. These are on the margins of the sandy moraine hills. Such belts of land are indicated on the map on the margins of the areas marked "less suitable for ponds".

All types of ponds are suited to this type of land but spring-fed ponds are particularly suitable.

7. Recommendations

Ponds meet a variety of needs on farms, many specifically related to conservation. A large number of ponds, hundreds or thousands, would contribute materially to conservation of water on the watershed. For these reasons the construction of farm ponds is recommended to property holders.

To promote this movement it is recommended to the Authority to set up demonstration ponds of the types described in the regions suitable for them. It is further recommended that experiments and tests be made in the construction of ponds filled entirely by surface run-off. The Authority could also promote a widespread practice of building ponds by making available to contractors and farmers in the district technical information on selecting specific sites, construction and maintenance of ponds.

WILDLIFE

CHAPTER 1

INTRODUCTION

There are three main objectives in conserving wildlife. The first is to retain for the citizens of this Province the opportunity to fish and hunt, within the law, in an attractive environment, and where possible to trap fur for profit. The second is to retain for every citizen the opportunity to see and enjoy the varied forms of birds, mammals and other wildlife of any region in the greatest possible variety. The third objective is the maintenance of a natural balance between the numbers of the various species. A hawk which preys on destructive meadow mice in an orchard may be worth many dollars to the farmer who protects it.

Land well adapted for wildlife should therefore produce or harbour a permanent population of interesting and useful species and an annual crop of game and fur. These populations should be adapted in agricultural land so that they have no adverse effect on all reasonable farming practices. The control of harmful species and the maintenance of all other animal populations at a desirable level through the provision of a proper habitat, or living quarters, is a natural branch of good land management. The traditional methods of wildlife management have included restrictions of the daily and seasonal kill and of the method of kill, predator control, reservations of game lands and artificial restocking. The provision of a proper habitat is often more important than all of these. In Southern Ontario, and in particular in the Nith Watershed, the amount of good habitat available appears to be the controlling factor in the abundance of most wildlife. The two chief requirements for wildlife planning in this area are therefore a study of the existing habitat and a study of the wildlife populations, particularly the dynamics or changes of populations over a period of several seasons. The second requirement cannot possibly be carried out in a rapid survey.

The fieldwork was therefore concentrated on a few of the more significant problems. The watershed provides a great variety of wildlife habitat, and the streams vary widely in suitability for fish. A beginning has only recently been made in the basic research on game environments in Southern Ontario. The techniques of stream and lake survey are at present farther advanced. In the present survey the chief detailed work was therefore a study of the environment for fish. Of all other wildlife only one species was chosen for detailed attention. This species, the European hare, is potentially harmful to reforested areas and to orchards. It is also the most important game animal of Southern Ontario.

CHAPTER 2

FORMER SPECIES

The animals found in the Nith Watershed are a mixture of northern and southern species with ranges which overlap in this area from two of the major life zones of North America. The overlapping ranges in the watershed of the cottontail and Yellow-breasted Chat, more southern species, and the varying hare and Northern Waterthrush, more northern species, are typical examples of the transitional character of the fauna.

The country probably supported a maximum of game and the larger forms of wildlife a few years after it was first settled. The great variety of open and ungrazed woods, cleared fields and forest edges provided food and shelter for large populations. The cutting, burning and grazing of much of the remaining forest and intensive hunting and trapping have since then greatly reduced the wildlife populations.

At least nine species of mammals which formerly must have been found in the watershed no longer occur in it. These include the beaver, timber wolf, black bear, marten, fisher, wolverine, otter, Canada lynx and wapiti or American elk. James Brown, founder of Nithburg, described a living elk which he encountered in the neighbourhood about the year 1830[1]. The cougar, generally a more southern species, may have occurred in the watershed; the moose, a more northern species, probably did not. The bobcat or bay lynx may still occur rarely in the watershed.

Of the birds which formerly nested in the watershed at least three species are no longer found in it. The Wild Turkey, which was "plentiful in the western and London districts"[2] previous to 1842, was decimated in the winter of that year, later reappeared in small numbers, but disappeared

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1. Lizars, R. and K. M. "In the Days of the Canada Company", Toronto, 1896.

2. Smith, W. H. Smith's Canadian Gazetteer, Toronto 1846.

for the last time about 1885. The watershed lay close to the centre of the breeding range of the Passenger Pigeon which is now extinct. Numerous records are cited of its breeding colonies in Oxford and Perth Counties[1]. This species, whose vast flocks astounded the early settlers, was still present in large numbers in 1860, declined steadily until 1880 and very rapidly thereafter. The last large flights in Southern Ontario occurred about 1876.

Bobwhite or quail were also common in the watershed in former times. This species increased with the first settlement of the land. A well scattered mixture of four types, woodland, brushland, grassland and cultivation in equal amounts, is considered particularly favourable to high quail populations[2]. Quail reached a peak of population about 1860. When the available cover was reduced they gradually disappeared. None was seen in the 1949 survey.

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1. Mitchell, Margaret H., "The Passenger Pigeon in Ontario", Royal Ontario Museum of Zoology Publication, 1933.

2. Leopold, Aldo -"Game-Management," Charles Scribner's Sons, New York, 1947.

CHAPTER 3

PRESENT SPECIES

1. Mammals

There was no intensive attempt during the survey to make a systematic collection of the smaller mammals of the watershed. The following list is therefore in part hypothetical. Species not taken or observed during the survey are included because there are other authentic records, or because their ranges surround the watershed and should obviously include it. The nine former species noted in Chapter 2 as no longer occurring in the watershed are not included in the list. Several of the bats listed may occur only in migration.

The arrangement and terminology of the list follow those in "A Provisional Check List of the Mammals of Ontario" by S. C. Downing (Misc. Publication #2, Royal Ontario Museum of Zoology, Toronto, 1948). Mr. Downing was good enough to provide assistance in preparing the list.

* Cinereous Shrew	Sorex cinereus Kerr
Smoky Shrew	Sorex fumeus Miller
Pigmy Shrew	Microsorex hoyi (Baird)
* Mole Shrew	Blarina brevicauda (Say)
Hairy-tailed Mole	Parascalops breweri (Bachman)
* Star-nosed Mole	Condylura cristata (Linnaeus)
* Little Brown Bat	Myotis lucifugus (LeConte)
Long-eared Brown Bat	Myotis keenii (Merriam)
Silver-haired Bat	Lasionycteris noctivagans (LeConte)
* Big Brown Bat	Eptesicus fuscus (Beauvois)
Red Bat	Lasiurus borealis (Müller)
Hoary Bat	Lasiurus cinereus (Beauvois)
* European Hare (Introduced)	Lepus europaeus Pallas
* Varying Hare	Lepus americanus Erxleben
* Cottontail	Sylvilagus floridanus (Allen)
* Black or Grey Squirrel	Sciurus carolinensis Gmelin
* Red Squirrel	Tamiasciurus hudsonicus (Erxleben)

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* Indicates that the species was taken or observed during the 1949 survey.

ж	Woodchuck	Marmota monax (Linnaeus)
ж	Eastern Chipmunk	Tamias striatus (Linnaeus)
	Eastern Flying Squirrel	Glaucomys volans (Linnaeus)
	Northern Flying Squirrel	Glaucomys sabrinus (Shaw)
	Beach Mouse	Peromyscus maniculatus bairdii (Hoy and Kennicott)
ж	White-footed Mouse	Peromyscus leucopus (Rafinesque)
	Cooper's Lemming Mouse	Synaptomys cooperi Baird
ж	Red-backed Mouse	Clethrionomys gapperi (Vigors)
ж	Muskrat	Ondatra zibethica (Linnaeus)
ж	Meadow Mouse	Microtus pennsylvanicus (Ord)
ж	House Rat (Introduced)	Rattus norvegicus (Erxleben)
ж	House Mouse (Introduced)	Mus musculus Linnaeus
ж	Meadow Jumping Mouse	Zapus hudsonius (Zimmermann)
ж	Porcupine	Erethizon dorsatum (Linnaeus)
	Brush Wolf	Canis latrans Say
ж	Red Fox	Vulpes fulva (Desmarest)
ж	Raccoon	Procyon lotor (Linnaeus)
	Ermine	Mustela erminea Linnaeus
	Long-tailed Weasel	Mustela frenata Lichtenstein
	Mink	Mustela vison Schreber
ж	Skunk	Mephitis mephitis (Schreber)
ж	White-tailed Deer	Odocoileus virginianus (Boddaert)

There are four additional mammals which may turn up in the watershed. They would certainly be of rare occurrence and are therefore not included in the list. These include the pipistrelle (a small bat), the water shrew, the pine mouse and the woodland jumping mouse. Two other species, the badger and the grey fox, which belong properly south of the Great Lakes, are known to be showing signs of increasing in Ontario and may eventually be found in the watershed.

2. Birds

The Nith Watershed includes many different kinds of habitat. It lies close to one of the main migration fly-ways in North America. It is therefore safe to assume that at least 250 and probably 275-290 different kinds of birds either

breed in or migrate through it in any given year. A list of these species would be largely hypothetical and would include almost all the resident and migratory species of Southern Ontario.

The following list of 109 species, based on field observations made by the 1949 survey party, includes only those that may be expected to nest regularly in the area or at least to spend the summer there. The arrangement and the names are from Taverner's "Birds of Canada" (1934).

Summer Birds of the Watershed

* Pied-billed Grebe
Great Blue Heron
Green Heron
American Bittern
* Least Bittern
* Mallard
Black Duck
* Blue-winged Teal
Wood Duck
* Turkey Vulture
* Sharp-shinned Hawk
* Cooper's Hawk
Red-tailed Hawk
Red-shouldered Hawk
Marsh Hawk
Sparrow Hawk
Ruffed Grouse
Pheasant
Virginia Rail
Sora Rail
Killdeer Plover
Woodcock
Upland Plover
Spotted Sandpiper
Rock Dove
Mourning Dove
Yellow-billed Cuckoo
Black-billed Cuckoo
Screech Owl
Great Horned Owl
* Long-eared Owl
* Whip-poor-will
Nighthawk
Chimney Swift
Ruby-throated Hummingbird
Belted Kingfisher
Flicker
* Pileated Woodpecker
Red-headed Woodpecker
Hairy Woodpecker
Downy Woodpecker
Kingbird
Crested Flycatcher
Phoebe
Alder Flycatcher
* Least Flycatcher
Eastern Wood Pewee
Horned Lark
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Cliff Swallow
Purple Martin
Blue Jay
Crow
Black-capped Chickadee
White-breasted Nuthatch
House Wren
* Winter Wren
* Long-billed Marsh Wren
* Short-billed Marsh Wren
Catbird
Brown Thrasher
Robin
Wood Thrush
Wilson's Thrush
Bluebird
Cedar Waxwing
Migrant Shrike
Starling
Yellow-throated Vireo
Red-eyed Vireo
Warbling Vireo
Black-and-white Warbler
* Golden-winged Warbler
Yellow Warbler
Black-throated Green Warbler
Cerulean Warbler
Chestnut-sided Warbler
Ovenbird
* Mourning Warbler
Maryland Yellowthroat
* Yellow-breasted Chat
Canada Warbler
Redstart
English Sparrow
Bobolink
Meadowlark
Red-winged Blackbird
Baltimore Oriole
Bronzed Grackle
Cowbird
Scarlet Tanager
* Cardinal
Rose-breasted Grosbeak
Indigo Bunting
* Purple Finch
Goldfinch
Towhee
Savannah Sparrow
Grasshopper Sparrow
Henslow's Sparrow
Vesper Sparrow
Chipping Sparrow
* Field Sparrow
White-throated Sparrow
Swamp Sparrow
Song Sparrow

3. Game and Fur

Apart from work on the European hare or jack-rabbit, no specific study was undertaken of the game and fur species of the watershed, but the status of the chief species may be briefly noted.

Cottontail	Generally distributed but not abundant.
Brush Wolf	A few are reported every year.
Red Fox	Reported to be very common.
Raccoon	Common, and reported to be increasing.
Mink	Generally distributed. A few are trapped every year.
Skunk	Abundant
White-tailed Deer	Abundant enough in most suitable territory to be rated a nuisance by some farmers.
Ducks	The watershed provides little suitable habitat for wildfowl. Most of the large ponds support at least one pair of Black Ducks. Mallards and Wood Ducks are the only other species which probably nest in the watershed.
Ruffed Grouse	A few remain in the larger wooded areas. The species is probably not cyclic in abundance in such reduced numbers.
Ring-necked Pheasant	Pheasants were scarce in the watershed at the time of the survey.
European Hare	(Described in Chapter 4).
Varying Hare	This species occurs in the Philipsburg woods, and possibly at a few other points in the watershed.
Muskrat	(Described in Chapter 6).

CHAPTER 4

THE EUROPEAN HARE

1. Introduction

The European hare or "Jackrabbit" (*Lepus europaeus* Pallas) is the most important small-game animal on the Nith Watershed.

Little scientific study has been made of the ecology of this species, and much of its life history has not been well understood.

The European hare was first liberated in Ontario a short distance outside the watershed, at Brantford, in 1912.[1] In its rapid spread it was not long in occupying most of the suitable range of the Nith, although the exact date of its arrival is not known.

Since it was released to the south of the watershed it seems safe to assume that it spread throughout the watershed from the south to the north. Howitt[2] (1925) reports hunting the species at Guelph in October, 1921, and says that it reached Puslinch Township, Wellington County, in the fall of 1923. Soper[3] (1923) reported that this species had been reported from several localities in Wellington and Waterloo Counties, especially in the Guelph region, and was "spreading...quite rapidly".

2. Methods of Study

While intensive work was concentrated in two sections of the watershed, in Mornington and Wilmot Townships, a more general survey was made of the status of the species over

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1. Dymond, J. R., 1922. The European Hare in Ontario. Canadian Field Naturalist. 36(8): 142-143.

2. Howitt, Henry, 1925. Another Invasion of Canada. Canadian Field Naturalist. 39 (7): 158-160.

3. Soper, J. Dewey, 1923. The Mammals of Wellington and Waterloo Counties, Ontario. Journal of Mammalogy, 4: 244-252.

the whole area. The area in Mornington Township (Concessions III-IV, Lots 13-15) provided an opportunity for studying the hares in an almost flat topography covered with pasturelands, pastured hardwood woodlots and mixed farm crops, and traversed with a small creek. The Wilmot Township area (Concession SSR, Lots 11-14) permitted observations in a region of rolling sand-hills (the "Baden Hills") covered with ungrazed mixed woodlands, pasture and mixed farm crops.

In both areas extended periods of study were carried on by watching the animals from semi-concealed vantage points, by traversing the regions on foot and by shooting specimens. Most observations were made by day, although they were sometimes carried out before first light, in the evening and after dark.

Interviews with farmers, sportsmen and Department of Lands and Forests personnel elicited considerable information, especially concerning population trends and damage to farm crops. The co-operation of other members of the survey party in reporting daily any hares seen was of considerable help; these observations were tallied and plotted as closely as possible on large-scale maps.

3. Habitat Preferences

Extensive open fields, pastures, croplands and scattered heavily pastured woodlands are the preferred habitat of the European hare at all seasons of the year. At the height of the summer's severest heat, open heavily pastured woodlots are much frequented by day. Hares were also occasionally flushed from "forms" in the thicker, ungrazed woodlots, but such locations were not frequently used.

No hares were found in any of the marshy areas of the watershed in summer, although it was reported that these locations are sometimes frequented in winter. According to Leopold[1] (1936) "game rodents" do not require drinking water in their diet.

1. Leopold, Aldo, 1936. Game Management. Scribner, New York.

Availability of preferred foods may influence the distribution of this species, although its ability to range widely and to subsist on a wide variety of herbage probably reduce the importance of food as a determinant of habitat suitability.

4. Food

On the basis of observations of the hares as they fed and examination of stomach contents of animals taken for study, a wide selection of plants appears to be used as food. Chief among the items taken in summer were: alfalfa, heads of oats, wheat and barley (both green and in the stook after cutting), dandelions, red clover, alsike clover, sweet clover and timothy hay.

Food preferences at other seasons of the year are imperfectly known, although observations elsewhere indicate that fall wheat, bark, twigs and buds of various trees and bushes, leaves, roots and tubers of almost all farm crops left in the field are eaten when available. Saunders[1] (1929) has recorded an instance in which a European hare was observed eating the flesh of a dead cottontail rabbit near Drumbo, Ontario. Whether or not the hare killed the rabbit was not known.

5. Habitat Suitability

Except in the immediate vicinity of urban centres of population, the agricultural regions of the watershed appear to be well suited to the European hare. As noted earlier, no hares were seen in the marshy parts of the area, but these represent only minor portions of the watershed. While extensive, well-kept woodlots appear to be inhabited only occasionally, such areas do not represent a large percentage of the watershed's total area and probably exert little limitation on the hare population.

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1. Saunders, W. E., 1929. Carnivorous Habit of the European Hare. Journal of Mammalogy, 10 (2): 170.

The level and almost treeless plains typical of Mornington Township provide little cover for wildlife other than the European hare.

Three American Egrets at Hallman's Pond, in Wilmot Township. A few of these spectacular birds wander into Southern Ontario every summer.

The Nith is sluggish but turbid in much of its lower course. This is its typical appearance in Blenheim Township.

Plotting on a map the daily reports of hares sighted on the watershed failed to demonstrate areas of either comparatively dense or light hare populations.

Considered as a whole, the watershed's topography, land use and cover are by no means constant, yet this variety does not appear to be sufficiently diverse to render any parts of the region better suited to the hare than others.

6. Present Status

During the period of active field work European hares were recorded either alive, as road-kills or as specimens secured on 152 occasions. The locations were widely scattered throughout the watershed, being somewhat more frequently recorded in central Wilmot Township, Waterloo County, than elsewhere, but this is not considered to indicate an actually greater population in that area, since more "observation time" was concentrated in this area.

Several methods of estimating hare populations were tried, with varying success. On one occasion several weeks' detailed observations of the Mornington Township study area were employed in an attempt to secure a quantitive determination of the population of hares in that area. At the end of the period six members of the survey party co-operated in a systematic "drive" of the area to count the hares present. The total of four hares observed agreed exactly with the previous estimate, representing a density of approximately three hares per square mile.

In the course of a "jack drive" in this same general area of Perth County during the winter of 1948-49, 30 hunters participated and the hare population was estimated to have been about 5 per square mile.[1]

Almost everyone interviewed agreed that the European hare is currently much less common than it was about

1. Conversation with E. Meadows, District Wildlife Specialist, Department of Lands and Forests, and J. Neeve, Department of Lands and Forests Overseer, July 5, 1949.

six or eight (some said ten) years ago. A few hunters held that the hare is now too scarce to make hunting worth while.

Despite this decline in recent years, almost no one interviewed believed that the decline is still in progress, and approximately half the informants were convinced that an increase in numbers was apparent during the past year or two.

Reasons given for the decline included excessive hunting (this mostly from non-hunters), predation by foxes, wolves, great horned owls and skunks (this mostly from hunters), and disease (this from both hunters and non-hunters). A few spoke uncertainly of periodic declines and increases in numbers without reference to the causes of such fluctuations. That the European hare population is subject to periodic fluctuations in its native range has been shown by researches carried on by Middleton[1] (1934), Naumov[2] (1940) and Siivonen[3] (1948). Whether or not this applies in Ontario is unknown.

7. Hunting Pressure

There has been a general upswing in hunting pressure all over Canada since the close of World War II. This has of course also occurred on the Nith Watershed. Now that the war-born shortages of hunting equipment, transportation facilities and manpower are almost forgotten most of the prewar hunters have returned to the quest of Southern Ontario's favourite small game. To their numbers have been added many an ex-serviceman whose wartime experiences accustomed him to the use of firearms for the first time and a host of office- and factory-workers seeking an outlet for the extra hours made available for recreation by changing labour codes.

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1. Middleton, A. D., 1934. Periodic Fluctuations in British Game Populations. Journal of Animal Ecology, 3 (2): 231-249

2. Naumov, S. P., 1940. Fluctuation in the Numbers of Hares. (In Russian, English Summary.)

3. Siivonen, Lauri, 1948. Structure of Short-cyclic Fluctuations... Finnish Foundation for Game Research, Helsinki.

On the Nith Watershed most European hares are taken in the course of organized "Jack-drives" in which up to forty or fifty hunters participate. While there are several organized Gun Clubs on and near the watershed, which sponsor these drives for their members, many of the drives are formed more or less spontaneously on week-ends by groups of sportsmen with common interests. Frequently groups of hunters from points as far away as Toronto and Windsor hunt in the area.

It is important to recognize three facts in any attempt to correlate hunting pressure and hare population at the present time: (a) the decline in numbers of European hares (and this appears to apply to most if not all of Ontario) became apparent in the two or three years immediately following 1940; (b) hunting pressure was at its lowest ebb during the years of most evident hare decline, viz: 1942-45; (c) despite the unprecedented increase in hunting pressure subsequent to 1945, the European hare population seems to have remained more or less uniform during this period and there are recent suggestions of a slight increase.

With this in mind, it is considered that the hunting pressure on the European hare population of the Nith Watershed, although admittedly high, is not excessive.

8. Predation

The actual importance of predators on the hare population of the watershed has not been assessed. The potential predators are many and include such diverse species as weasels, shrews and several species of hawks and owls that may prey on the new-born young; foxes, wolves, domestic cats and dogs, great horned owls and snowy owls, which may prey on the adults.

Foxes were almost universally condemned by hunters on the watershed but this condemnation was based almost entirely on speculation, no large-scale food habits study of the fox in areas inhabited by numbers of European hares having ever been undertaken.

European hares do occur in some areas of New York State, but none are specifically mentioned as being among the food items found in fecal pellets examined there by Seagears[1]. Two extensive studies of fox feeding habits have been carried out in Iowa by Scott[2] and Errington[3] respectively. In the former, hares of the genus Lepus were reported to have been virtually absent from the study area and the remains of only one were detected.

In Errington's study, a species of hare (Lepus townsendii) was represented 264 times among 3,858 food items about dens and 63 times in 2,110 fecal samples collected about the same den. These figures indicate that the fox is capable of taking at least some species of hares, but the rate of occurrence is not high, and the applicability of these figures to the fox and the European hare in Ontario is unknown.

The effects of all other mammal predators, including domestic cats and dogs, on the European hare population are unknown.

Similarly, although a few studies have been made on the feeding habits of various birds of prey in Ontario (e.g., Synder, 1932 and Banfield, 1947) none has been sufficiently widespread geographically, extended over a sufficient number of months, nor dealt with a sufficient number of specimens, to permit generalizations with respect to European hares.

The effects of disease and parasitism are almost totally unknown with respect to the European hare. The effects of Nematodes, Trematodes, "shock disease" and many other factors that have been shown to reduce vitality and increase death rate in other species of hares have received scant attention in the European hare.

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1. Seagears, Clayton B., 1945. The Fox in New York. State of New York Conservation Department Educational Bulletin, Albany, New York.

2. Scott, Thos. G., 1943. Some Food Coactions of the Northern Plains Red Fox. Ecological Monographs, 13 (4): 427-479.

3. Errington, Paul L., 1937. Food Habits of Iowa Red Foxes During a Drought Season. Ecology, 18 (1): 53-61.

The present study has shown that this hare is by no means without parasites, but much more work along these lines will have to be done to determine their importance.

9. Crop Damage

According to reports of farmers on the watershed, damage to orchards and truck-farms was considerable in the years when hares were more common than at present. No serious complaints of recent origin were heard, which seems to have been the result of great reduction of both hares and orchards on the watershed.

Farmers were encountered in the north-western section of the watershed who maintained that they had ceased attempts to grow apples because of the depredations of European hares a few years ago.

This mammal is a potential menace to orchards, especially in years when deep, crusted snows permit it to travel on the surface and reach the lower branches and trunks. In New York State the damage to small fruit trees during the winter 1915-16 was estimated to have exceeded $100,000 in Dutchess County alone (Silver[1]). No estimate has ever been made of damage in Ontario.

Wire mesh guards provide some protection for small trees in winters when the snow does not cover them, but these are often rendered completely useless when conditions permit the hares to travel on top of the snow to reach the unprotected parts of the trees.

Hamilton[2] lists a number of repellent washes that may be useful, but admits that none is reliable. Roadhouse[3]

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1. Silver, James, 1924. The European Hare (Lepus europaeus Pallas) in North America. Journal of Agricultural Research, 28 (11): 1133-1137.

2. Hamilton, W. J., Jr., 1935. Field Mouse and Rabbit Control in New York Orchards. Cornell Extension Bulletin 338, Cornell University, Ithaca, New York.

3. Roadhouse, L.A.O., 1949. Final Report (of) Rodent Repellent Studies. Report No. 3-3-49, Research Council of Ontario, Toronto.

tried a variety of compounds in the laboratory and it appears that some of the ones tested might be useful as repellents, but he failed to carry the investigation to conclusion with tests in the field. At least one chemical is said to be available in the United States which satisfactorily repels deer and some other animals, but no data on its applicability to European hares are at hand.

The economic importance of the hare's attentions to such preferred foods as alfalfa, clover and fall wheat should be mentioned.

The present low population of hares on the watershed probably does not affect the farm economy to any great extent through their depredations in alfalfa, hay and grain, but if they ever again attain anything like their former numbers they may do considerable damage. Studies elsewhere[1] have shown that several other species of hares sometimes offer serious competition to cattle and other range animals.

Several writers referring to the early spread of European hares in Ontario decried the hares' damaging effects on the farm by consuming the leaves of fall wheat. Apparently these fears were unfounded. In fact many farmers allow cattle to crop the plants in years when unseasonably warm weather causes excessive growth. Most farmers claimed that this had no adverse effect on the plants as long as it was not continued into the spring growing season.

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1. Vorhies, C. T., and W. P. Taylor, 1933. The Life Histories and Ecology of Jackrabbits Lepus alleni and Lepus californicus ssp., in Relation to Grazing in Arizona. Arizona Agricultural Experimental Station Technical Bulletin 49: 471-587.

   Taylor, Vorhies, C. T., and P. B. Lister, 1935. The Relation of Jackrabbits to Grazing in Southern Arizona. Journal of Forestry, 33(5): 490-498.

   Phillips, P., 1936. The Distribution of Rodents in Overgrazed and Normal Grasslands of Central Oklahoma. Ecology, 17 (4): 673-679.

   Parker, K. W., 1938. Effect of Jackrabbits on the Rate of Deterioration of Range Lands. New Mexico Experimental Station (Agriculture) Bulletin No. 839.

   Arnold, Joseph F., 1942, Forage Consumption and Preferences of Experimentally Fed Arizona and Antelope Jack Rabbits. Arizona Agricultural Experimental Station Technical Bulletin No. 98: 51-86.

CHAPTER 5

IMPROVING THE FARM FOR WILDLIFE

Recommendations for specific improvements for individual farms in the Nith Watershed would involve detailed examination beyond the scope of the present survey. Moreover the requirements such as cover and food vary greatly for different species. On the Nith Watershed the existing conditions are also widely divergent. From the Ellice Swamp northward through Mornington Township much of the land is flat and open, with bare fences, dry stream beds and cover reduced to overgrazed elm - soft maple woodlots. In the hilly sections of Blenheim and Dumfries Townships there are many wooded valleys and good cover is comparatively common. Between these two extremes there are many varied types of land. The recommendations here listed are therefore those which can be most generally applied by the landowner himself.

1. Woodlands

The elimination of grazing of woodlots would be the most useful single measure in improving the wildlife environment. Large-scale reforestation plans are included in the Forestry report. In plantations, up to about the tenth year from planting, the entire planted area is valuable for wildlife. But large blocks of coniferous trees will, at least after the twelfth year from planting, have little or no undergrowth and will, apart from their edges, be comparatively sterile as far as upland game and most forms of wildlife are concerned. The chief improvements to be expected will therefore come from good management of the farm woodlot. Selective cutting is both sound forestry practice and good planning for wildlife. Landowners who have woodlots in which the crown canopy has closed over considerable areas, and who wish to produce a proper environment for wildlife, will find that release cuttings, slashings to stimulate sprout growth, thinnings and felling timber for sale will improve rather than

retard the carrying capacity for wildlife. Construction of brush piles from cuttings is recommended where rabbits are desired, two or three such brush piles per acre being the normal spacing.

2. Cultivation Practices

All good farming practices which make a more luxuriant vegetation will improve the farm environment for wildlife. A few special practices will give more specific benefits. Strip-cropping, described elsewhere in this report, is of particular value since by this means no extensive area is denuded of cover at one time by harvesting. In the less flat parts of the watershed, filter strips, either above water-diversion terraces or used as emergency waterways, provide travel lanes and nesting cover for wildlife. Cover crops such as the clovers provide a habitat and food for wildlife in areas that would otherwise be barren during the winter months.

The elimination of brushy fencerows is now the rule rather than the exception on Southern Ontario farms. Those who are interested in wildlife improvement will find that the inclusion of a few field boundary hedges on the farm will moderate the effect of winds on crops, serve as travel lanes and cover for wildlife, and harbour large numbers of songbirds which help to control insect pests. Inevitably the presence of boundary hedges on a farm tends to encourage the growth of weeds. This is the price that must be paid for improved wildlife conditions. *Rosa multiflora* is an excellent hedge-forming shrub. It has a tendency in Southern Ontario to die back in winter, but rapidly forms a dense hedge, which is reported to be proof against cattle and hogs. It provides both cover and food and does not exhaust the nearby cultivated ground.

3. Food and Cover Patches

Field corners are frequently barren of crops. Therefore a fence crossing which embraces the corners of four

fields may be made into a haven for ground-nesting species by planting a few trees and shrubs and protecting them. It is important to rid such areas of useless weeds by crowding them out with useful species such as white sweet clover or the normal climax type of open vegetation which is bluegrass.

There are still several groups of sportsmen who would like to see pheasants permanently established in this part of Southern Ontario, and pheasants are frequently released in the watershed. An investigation of the status of pheasants in Ontario, carried out by the Provincial Department of Lands and Forests, has shown that most of the Nith Watershed is unsuitable for the species. Even the more southerly part of the watershed provides only marginal pheasant territory. The average snowfall, 70 to 80 inches, is comparatively heavy for Southern Ontario, and the watershed is also more often subjected to sleet storms than most of the Province[1]. There is also a serious shortage of cover for pheasants in the northern half of the watershed. Periodic winter killing of most or all of the population may therefore be expected. A fair population was built up in some sections by 1944, but practically no birds survived the winter and spring of 1944-45 and the species is still uncommon. Pheasants which have to be fed at the barnyard can hardly be compared with ordinary wild game. Those who wish to farm the species should provide food patches to supplement the available diet of scattered ragweed and other low plants. Short rows of standing corn or corn in shocks should be left close to good cover. Buckwheat, soybeans and Japanese millet are also recommended. Disused and loose rolls of fence wire left at the edges of woodlands provide useful additional cover. It need hardly be added that any gullied area in which groups of evergreen trees are planted for erosion control is also of value to wildlife.

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1. Clarke, C.H.D., and R. D. Braffette: "Ringnecked Pheasant Investigations in Ontario 1946". Department of Lands and Forests, Ontario.

4. Ponds and Streams

The importance of water to wildlife is often forgotten. Many farms have at least one low spot where a small amount of work with a scoop will provide a dam and a pond to provide nesting and feeding sites for water and marsh birds. If possible ponds for wildlife should be separate from those intended for cattle or for fish. Willow cuttings pushed in the ground around such a hollow will rapidly provide wildlife cover. New water areas will soon be invaded by aquatic plants, but additional species may have to be introduced. No extensive duck food studies have been made in Southern Ontario. Wild rice may be introduced, but since it is not well adapted to wide variations in water levels, being often sterile in fluctuating waters, it cannot be considered as certain to succeed. The idea has long been current, and is fostered by many sportsmen's organizations, that the planting of wild rice is the answer to the problem of how to attract ducks to any area. The fact is that wild rice is of little significance to ducks in Canada except in the fall, and does not provide good cover or nesting sites. The following species which may be easily obtained are recommended as certain to be valuable duck foods. If none of them occur in ponds or shallows with good cover for ducks they can be introduced.

Sago Pondweed	Potamogeton pectinatus L.
Red-Head Pondweed	Potamogeton Richardsonii (Ar. Benn.) Rybd.
Wild Millet	Echinochloa crusgalli (L) Beauv.
Japanese Millet	Echinochloa frumentacea (Roxb.) Link
Wild Celery	Vallisneria americana Michx.
Knotweed	Polygonum pensylvanicum L.
Water-Smartweed	Polygonum coccineum Muhl.
Three-square	Scirpus americanus Pers.
Great Bulrush	Scirpus validus Vahl., var. creber Fern.

Those who are interested in farm ponds for wildlife will find very useful details of the various types of pond and methods for constructing each type in the chapter on Farm Ponds in the Land Use section of this report. Farm ponds differ from those intended for wildlife in that care is

usually taken to prevent the growth of aquatic vegetation in a farm pond intended only for watering stock or fire protection purposes. Otherwise the construction and details of ponds for wildlife should follow one of the types there described.

CHAPTER 6

MANAGEMENT

In agricultural land a large part of wildlife management is inevitably the establishment and enforcement of sound regulations defining game and fur species, open territory, open seasons and the quantity and methods of catch allowed. Most game management factors do not fall within the scope of this report. In Southern Ontario the chief problem now is not the establishing of new regulations but the great difficulty of enforcing regulations already in the statute books. A great many hunters and trappers do not regard game regulations with the same respect accorded to other Dominion and Provincial legislation. Increased education of the public concerning the reasons for game regulations is therefore important.

1. Game Preserves

There are three Crown Game Preserves within or partly within the watershed, as shown on the accompanying map (following page 24). Game preserves in agricultural land are normally set up as a result of a local movement by owners of some of the land involved. The existence of game preserves raises the question as to what game they are intended to preserve. Species such as the jackrabbit and fox do not appear to be in any need of protection. The most recent increase in fox populations occurred while hunting was also increasing. Some game preserves have certainly helped to preserve remnants of species such as the Ruffed Grouse, which cannot be expected to repopulate surrounding areas. They also are of value to deer, whose place in agricultural land is open to question.

The old theory of game preserves as reservoirs from which there will be a flow of game to repopulate other areas by population pressures is probably exaggerated, since only the area close to the edge of the preserve can do this. In any case the preserves appear larger than necessary for this purpose. More and better distributed small game refuges of

100 acres or less would be much more effective. The ideal for upland game would be numerous game refuges of from half an acre to two or three acres established by individual farmers. But these are not of much account unless a species of game can be found which is fully at home in the agricultural land of Southern Ontario, north of the narrow strip suitable for the Ring-necked Pheasant. The European hare has already attained this status, but at times it causes damage. The Hungarian Partridge may be the species needed.

2. Muskrat Management

Muskrats are not a major source of revenue in the watershed, but they are a useful supplementary source of income. When the survey was completed three facts were apparent.

(a) There was no shortage of muskrat foods in the permanent waters of the watershed. The accompanying map shows the condition at the time of the survey[1].

(b) Field observations, supported by many reports from trappers and others[2], indicated that the muskrat population was very low at the time of the survey and had decreased most markedly in the five years preceding the survey.

(c) Spring flooding could not be considered an important factor in the reduction of the population. The chief cause was undoubtedly overtrapping and illegal trapping (trapping houses and burrows, shooting, out-of-season trapping and fall trapping). The high prices of fur then prevailing, the great increase of trappers, and the altering of the age requirements have been partly responsible.

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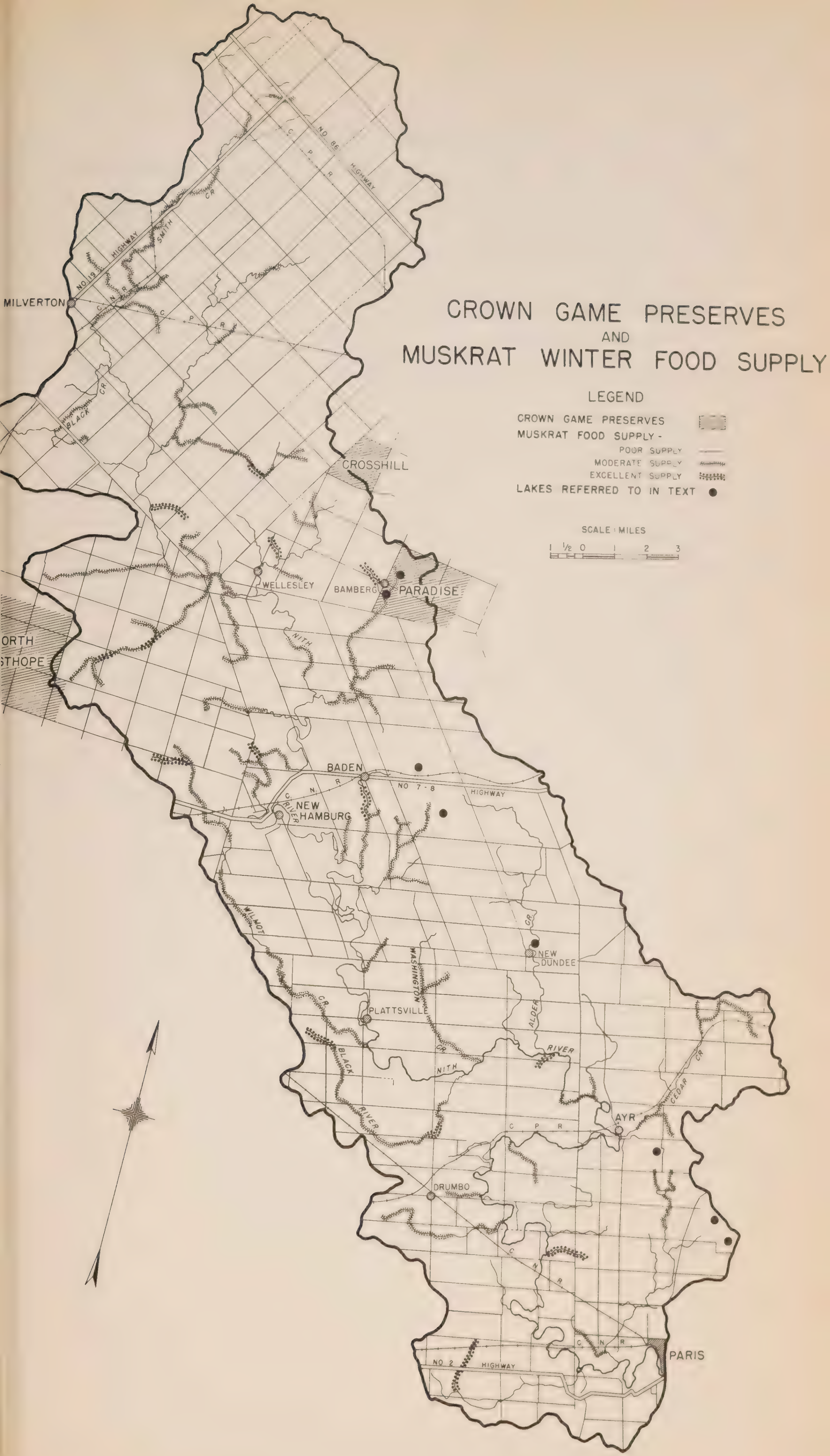
1. The largest true marsh is immediately below New Hamburg and covers only 5 acres. This area is now posted, but formerly produced 40-60 rats annually. The marshes in the vicinity of Bamberg Lake are excellent and not trapped. The New Dundee marsh is excellent but heavily trapped. The group of marshes on the edge of the watershed including Twin and Spottiswood Lakes are good habitat, closely trapped. On the major watercourses the rat population is scattered rather uniformly. One trapper using 150 traps set for a week on 15 miles of trapline caught 150 muskrats.

2. The survey is indebted particularly to Messrs. Gerald Dunbar, H. McCloy and Russell Bannister for information concerning the trends of population in recent years.


CROWN GAME PRESERVES
AND
MUSKRAT WINTER FOOD SUPPLY
LEGEND
CROWN GAME PRESERVES
MUSKRAT FOOD SUPPLY -
POOR SUPPLY
MODERATE SUPPLY
EXCELLENT SUPPLY
LAKES REFERRED TO IN TEXT
SCALE: MILES
1 ½ 0 1 2 3
MILVERTON
NO. 19 HIGHWAY
NO. 86 HIGHWAY
C P R
C N R
SMITH CR
BLACK CR
CROSSHILL
WELLESLEY
BAMBERG
PARADISE
NITH
ORTH
STHOPE
BADEN
NO 7-8 HIGHWAY
NEW HAMBURG
RIVER
CR
NEW DUNDEE
WILMOT
WASHINGTON
PLATTSVILLE
ALDER
RIVER
CR
BLACK
NITH
RIVER
CEDAR CR
AYR
DRUMBO
C N R
PARIS
NO 2 HIGHWAY

Several useful suggestions for increasing the annual yield were put forward by trappers. The first of these was that the trapping season might be reduced to 10 or 12 days and the open dates decided locally, to catch the run of males and leave the females. A good idea in theory, this would be difficult to put into practice. Some trappers suggested an even shorter season. Another suggestion concerned the selling of licences. At present there is no limit to the number of licences sold. The striking success of the registered trap line system in Northern Ontario suggests that some way might be found to adapt it to Southern Ontario. Several trappers felt that if licences were sold only to those who could show written permission of the owner to trap a certain area, overtrapping might be practically eliminated, and trappers would be encouraged to take only the annual increment each year. None of these suggestions would be of much use without closer supervision, which would hardly be possible without an increase in the number of game supervisors.

CHAPTER 7

THE MEADOW MOUSE

1. Status

Most people are aware of the damage which the meadow mouse (*Microtus pennsylvanicus*) can inflict on young orchard trees. Meadow mice can also girdle and destroy young trees, both hardwood and softwood, in reforestation projects and nurseries.

One example should indicate the danger. In the winter of 1947-8 on a farm near Exeter, Huron County, 95 per cent of 26,000 trees in a 20-acre plantation of Scotch pine were girdled and killed in a few weeks by meadow mice. Similar devastation took place in a plantation in York County in 1944. Since considerable areas of the Nith Watershed are being recommended for reforestation, the possibility of meadow mouse damage cannot be ignored.

Indications of four-year cycles in the population of this species have been reported from New York State[1] and Ohio[2]. Records of the Royal Ontario Museum of Zoology show no signs of a widespread uniform population cycle in Ontario. It seems more probable that in Ontario at least the critical factor in population changes may vary in different years. It may be any one of a number of climatic factors such as the depth of snow, occurrence of freezing rain, or some other factor such as predator abundance, food supply and disease.

Examination in 1949 of twelve plantations in the Nith Watershed which would normally support fair populations of meadow mice indicated that the species was comparatively scarce. The twelve plantations were selected at random. Seven showed evidence of mice and the species was abundant in two of them.

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1. Hamilton, W. J., "Field Mouse and Rabbit Control in New York Orchards", Cornell Extension Service Bulletin 338.

2. Bole, B. P., "The Quadrat Method of Studying Small Mammal Populations", Science Publications of Cleveland Museum of Natural History No. 4.

No damage was being done in either of these, since mice do not attack trees in summer. Previous damage from mice was noticed in only two plantations. Four of the plantations were considered very vulnerable to Microtus, i.e., having long grasses providing cover and having a local population of Microtus nearby. In any given year in Ontario the chances are small that a large population of meadow mice will be built up in the summer and will continue to breed in the fall and survive until snow is deep on the ground. But when this does happen any plantation which is overrun will be decimated. There is no doubt that to reforest any area having a dense mat of tall grasses or sedges (the preferred range of the mice), without protecting it from mice by some means, is to invite disaster. Both idle, poorly drained sand lands and muck areas covered with willow scrub or similar vegetation can support large populations. Plantations on well drained sandy slopes are also vulnerable if they adjoin low areas of long grass and sedges. There are several areas of land of this type which are recommended for reforestation in the Forestry section of this report.

2. Control Measures

Protection of the trees until they are eight to ten years old will probably in the long run prove to be more satisfactory than attempts to kill all the mice. A proper balance between the numbers of mice and of their predators would also help to prevent the mice from increasing too quickly. The protection of natural predators, such as hawks, owls and foxes, is therefore one of the simplest and cheapest aids to control of mouse populations. Control measures involving protection of the trees include:

(a) Clean cultivation of the ground prior to planting.

(b) Cutting and removal of grass, at least semi-annually in areas where mice are present.

(c) Repellents.

Laboratory tests[1] have already suggested a number of compounds which successfully repel rats. Further tests under natural field conditions will have to be carried out on the most promising of these repellents in order to evaluate their efficiency against the meadow mouse, and to ensure that those selected for production would not be toxic to the trees in plantations.

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1. Roadhouse, L.A.C., "Rodent Repellent Studies", Research Council of Ontario, Report 3-3-49, October 1949.

CHAPTER 8

FISH

The purpose of this survey was to make a preliminary examination of the waters of the drainage basin and to classify them as to their present suitability for fish, and secondly to make recommendations for possible improvements.

1. Methods

The river and its tributaries were visited at 260 "stations" corresponding generally to the crossings of the river by roads. The stations were from one to three miles apart. The topographic features of the valley and the erosion, vegetation and volume of flow, turbidity, temperature and type of bottom were listed at each station. At all suitable stations collections of the aquatic insects and other invertebrates were made. At most of the stations collections of fish were also made. The collections were later examined and classified, and were used in zoning the various sections of the river as shown on the accompanying map. The aquatic insects such as mayflies, stoneflies and caddisflies were most useful for this purpose, since many of them are reliable indicators of the stream conditions at the critical time of year. Some species are confined to waters which remain cold and clear in summer, such as trout waters. Others are indicators of permanent flow or of polluted water or of the maximum summer temperature of the water. Thus the potentialities of a stream for particular species of fish are indicated. The fish collections substantiated these findings at their particular stations.

The procedure here adopted follows that used in previous river surveys by the Department of Planning and Development and allows close comparisons of the characteristics of many rivers. The present criteria and methods evolved from more intensive year-round research carried out on parts of the Nottawasaga River and Algonquin Park streams, already reported

on, [1,2,3] and from other unpublished research data made available for this work. The present survey was carried out from mid-June to mid-September. Each station could only be examined once. It was therefore necessary to rely on deductions from the presence or absence of species which extensive previous tests have shown to be reliable indicators.

2. The River Valley

A few significant points may here be emphasized. The conditions which determine the kinds of fish inhabiting a river are in part a product of the physiographic conditions of the watershed. Most of the Nith Watershed is undulating or rolling land, but the section north from Nithburg to the boundary appears to the eye remarkably flat, although in fact it slopes uniformly to the south-west. There are many small narrow watercourses traversing this northern section, but most of them are dug ditches. Below Nithburg the main valley widens out. Large meanders begin at Philipsburg.

The valley curves along the south-west side of the watershed, with a single diversion eastward to the village of Ayr. There are many short tributaries, mostly five to eight miles long, with a single one of twelve miles. Only two significant tributaries flow in from the west.

The gradients of the river and its chief tributaries are shown in the following table.

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1. Ide, F. P. The Effect of Temperature on the Distribution of the Mayfly Fauna of a Stream. University of Toronto Studies, Biology 39, Publication Ontario Fish Research Laboratory 50. 1935.

2. Ide, F. P. Quantitative Determination of the Insect Fauna of Rapid Water. University of Toronto Studies, Biology 47, Publication Ontario Fish Research Laboratory 59. 1940.

3. Sprules, W. M. An Ecological Investigation of Stream Insects in Algonquin Park, Ontario. University of Toronto Studies, Biology 56, Publication Ontario Fish Research Laboratory 69. 1947.

TABLE I

Watercourse	Length in miles	Drop in feet	Gradient in feet per mile
1. Nith River:			
Source to Paris	98	650	7
Source to Nithburg	24	236	10
Nithburg to Paris	74	424	6
2. Cedar Creek	6	70	12
3. Alder Creek (including Mannheim Creek)	13	225	17
4. Mannheim Creek	8	145	18
5. Washington Creek	6	160	26
6. Bamberg Creek	8	115	14

Rock outcrop occurs only in the lower half-mile of the river. The main river tends to be turbid from its source to the mouth. Sandbars were reported at wide intervals from Nithburg to Paris, but most of the river bottom is covered with at least two inches of silt. The banks are, with few exceptions, pastured and livestock are commonly watered in the stream. Bank erosion is common along the main river course, especially in the lower part of the river.

3. Permanence of Flow

The Nith Watershed is very narrow. The main river has therefore many short tributaries and no long ones. The accompanying map shows the large number of tributaries in the northern section of the watershed which supply little water to the river except surface drainage from an undulating and comparatively impermeable till plain. The Township of Mornington and most of the land surrounding it is of this type. Most of the streams in this area dry up completely or to standing pools in the summer. The permanent spring-fed tributaries come chiefly from the intersection of gravelly morainic overburden and less permeable material. The main gravelly soils are in Wilmot, Dumfries and Blenheim Townships

Smith Creek, in Mornington Township, is typical of the many tributaries with little summer flow in the northern part of the watershed.

Mud flats above New Hamburg dam. This part of the river is heavily polluted by sewage.

Rootstocks of the common yellow Water Lilly are a useful muskrat food. These are in Hofstetter Lake, Wilmot Township.

and in the southern part of Wellesley Township. It is therefore in and near these townships that most of the permanent springs arise. The relationship between the permeable and impermeable soils in the watershed is well illustrated in the map of Pond Regions in the Farm Ponds section of this report.

Flow in the main Nith above Paris is subject to very great variation. The greatest daily mean flow recorded in the ten years in which flows were measured at the Canning gauge was 10,500 cubic feet per second, and the lowest was 20 c.f.s. Since the whole flow of the Grand River has been known to fall to a daily mean at Galt of 20 c.f.s., the Nith must in extreme drought fall far below 10 c.f.s. The flow in most summers probably does not fall below a daily mean of 30 c.f.s.

4. Temperature Conditions

The chief stream temperature characteristics affecting the distribution of fish of the Nith are shown on the accompanying map and in Table II. The differences in thermal conditions shown result from a variety of causes such as volume of flow, amount of shade and origin of the water, which cannot be individually shown on the map.

Areas suitable for speckled trout do not normally extend beyond the parts of the streams shown in blue. The blue sections have a low maximum temperature, little daily temperature fluctuation and a low daily mean temperature. They also are normally spring-fed and with few exceptions are well shaded in summer.

The high daily maxima and moderate temperature fluctuations in the sections shown in red result normally from a relatively large volume of flow retaining its heat from day to day. Impounded waters in which only the surface water passes over a dam tend to keep the lower stream sections warm.

The greatest daily fluctuations in temperature are found in the sections coloured green on the map. This

BIOLOGICAL CONDITIONS OF STREAMS

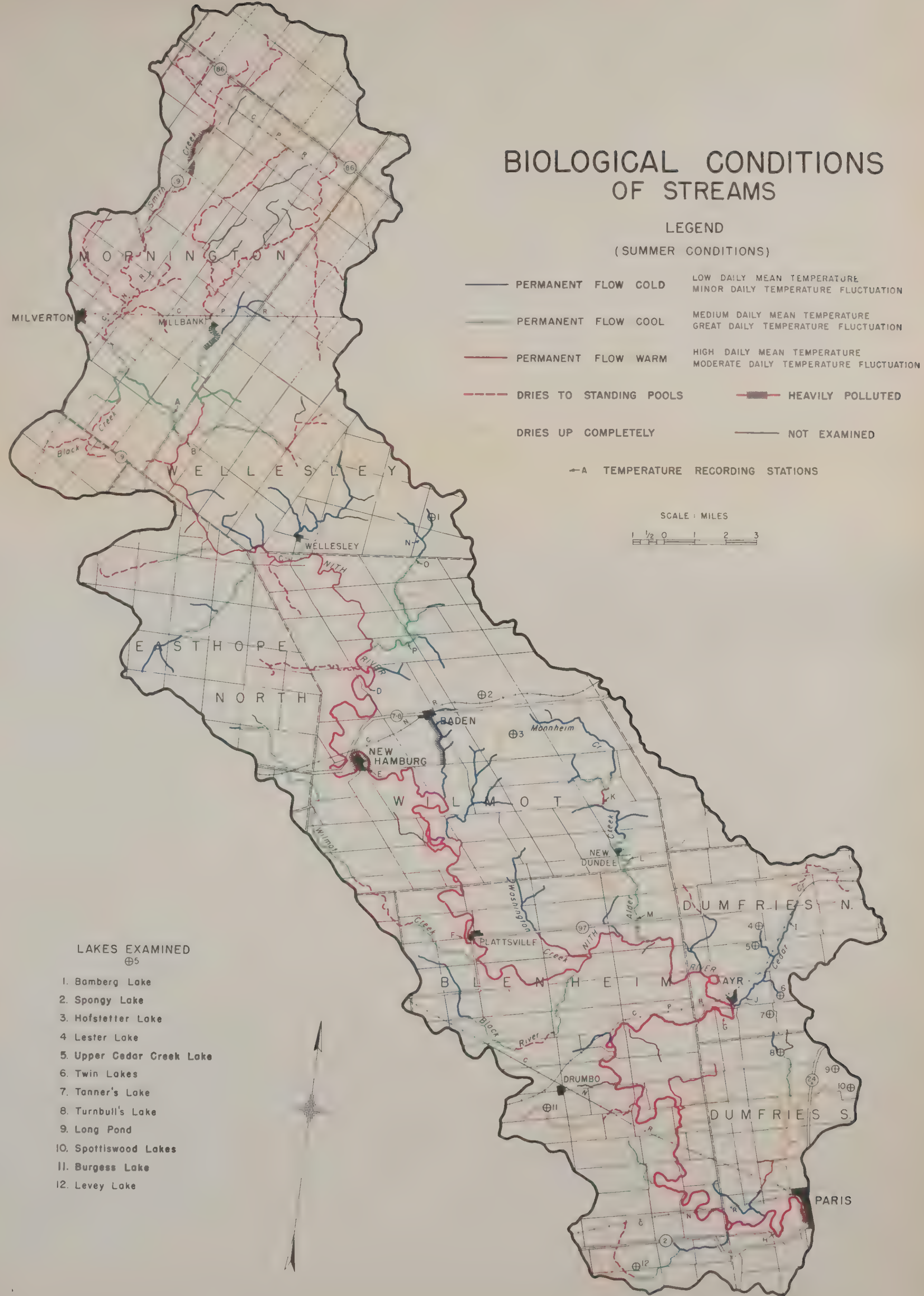

TABLE II

RIVER TEMPERATURES

Temperatures[1] in the main Nith River, July 14-25, 1949								
Station No.[2]	A	B	C	D	E	F	G	H
Maximum Temperature	73	88	85	83	84	86	77	88
Average Maximum	72	86	83	81	81	85	74	82
Average Minimum	65	64	68	68	70	69	70	68
Minimum	62	59	66	65	67	68	68	64
Mean (from average maximum and average minimum)	69	75	76	75	75	77	72	75

Temperatures[1] in three Tributaries of the Nith River, July 25 - August 5, 1949								
Station No.[2]	Cedar Creek		Alder Creek			Bamberg Creek		
	I	J	K	L	M	N	O	P
Maximum Temperature	61	77	84	79	78	74	81	85
Average Maximum	58	73	80	77	74	70	79	80
Average Minimum	49	59	66	60	63	52	65	64
Minimum	48	57	60	55	58	48	60	58
Mean (from average maximum and average minimum)	54	66	73	69	68	61	72	72

1. Temperatures are given correct to the nearest degree Fahrenheit.

2. Location of the stations (by letter) is shown on the map of Biological Conditions of Streams.

situation is found some distance down stream from spring-fed tributaries, where there is no longer a cooling effect in day-time, or where no impoundments supply a large volume of warm overflow.

5. Pollution

Polluted water may be classified according to the source of the pollutant and the severity of its effects. The chief sources of pollution are milk wastes (from creameries and cheese factories), cattle droppings, sewage (both raw and treated[1]) and various industrial wastes. There is also a group of substances such as fibre, sawdust and silt which are not normally considered as pollutants, but which may render the river bottom unsuitable for fish or unproductive of bottom fauna.

Pollution effects are of two kinds: those affecting public health and those which are not a hazard to human health but which are offensive to people or harmful to fish and other aquatic organisms. The first type is measured by the concentration of an indicator organism (the bacillus E. coli). The second type is measured in terms of poisonous compounds which may be introduced into the river and in terms of oxygen depletion and the oxygen demand[2].

The Nith River passes through few towns or villages and is comparatively little affected as a fish habitat by pollution. The accompanying map shows the parts of the river which are seriously affected for fish by pollution. The watercourses at Millbank and Carthage are heavily polluted by milk wastes. The dissolved oxygen of the river was close to zero near the effluents at these places at the time of measurement, but recovery to fair conditions took place within a mile below the effluents.

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1. Sewage effluents may be bacterially inoffensive but harmful because of a too high chlorine content.

2. The B.O.D., or Biochemical Oxygen Demand, is a measure of the oxygen that will be demanded by the material in the course of its complete oxidation biochemically. It is determined wholly by the availability of the material as a bacterial food and by the amount of oxygen utilized by the bacteria during its oxidation.

The effluent from an industrial plant at Baden seriously pollutes the tributary into which it flows. The following table shows the results of measurements made on three dates at a point 200 yards downstream from the effluent. The effects of pollution are still apparent more than a mile below the effluent. From the standpoint of public health the hazard no doubt continues much farther downstream.

TABLE III

WATER CONDITIONS ON THE BADEN TRIBUTARY

NITH RIVER 1949

	Aug. 20	Aug. 25	Sept. 2
Temperature (C.)	14	17	16
Dissolved Oxygen 9p.p.m.)[1]	6.4	6.4	6.3
Per cent saturation (oxygen)	61.5	65	63.5
5 day 15° C. B.O.D. (p.p.m.)	6.2	6.2	5.3

Numerous measurements were made of the oxygen content and also of the B.O.D. in the Nith during the survey, as a part of a more extensive survey of rate of recovery of water from pollution on the Grand River. Results of these tests are available for reference. Most of the Nith water tested showed conditions satisfactory for fish life, but not necessarily for public health. Thus at New Hamburg, where the oxygen content when measured was not seriously low and the B.O.D. was not very great[2], raw sewage enters the stream at many points and the <u>E. coli</u> count, if taken, would certainly show that the water could never be safely used for swimming. More serious pollution affecting also the fish life occurs at intervals at New Hamburg during cleaning operations at the mill.

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1. Parts per million.

2. Conditions at New Hamburg dam, August 19, 1949.
   Temperature 16° C.
   Dissolved oxygen, p.p.m. 6.6
   Per cent saturation 66
   5 day 15° C. B.O.D. p.p.m. 2.8

Inefficient settling beds, which do not clear the effluent from a plant on the Baden stream.

This farm pond is fed by water diverted from a stream in which a small check dam, not visible in the photograph, has been placed. The pond therefore does not accumulate silt and cannot become flooded.

Bank erosion on the Nith at Paris.

In many spots the Nith River is used as a dumping-ground for all kinds of refuse and garbage. Although the laws concerning pollution prohibit such dumping, in practice education is the recognized preventive.

6. Possible Improvements

Milk wastes have already been the subject of considerable research in Ontario. From this work[1] it is already clear that the septic tank provides an adequate primary treatment for milk wastes, where the dilution factor in the stream is large. In other situations, including those at Millbank and Carthage, an efficient secondary treatment device such as a sand filter or a field tile bed should be kept in working order to treat the effluent from the septic tank.

The pollution of the Baden tributary by industrial wastes, while severe, is only one example of conditions which are as bad or worse in many other parts of the Grand River system. The same is true of the septic conditions of the Nith at New Hamburg from sewage. So long as many municipalities and other public bodies, as well as individuals, ignore the provincial legislation against stream pollution, no one can expect industrial companies to improve their conditions. The present legislation concerning pollution is both so general and so severe that in most cases it cannot be enforced without disrupting the economic life of the province. Since the provisions are difficult to enforce, abuses are now common. Any changes in the present legislation must obviously be made in such a way that no company is made to feel that it is handicapping itself (compared with others) in taking the lead in pollution abatement.

The solution appears to lie in defining more exactly the requirements of water purity not only for public health, but also for industrial uses and for the propagation

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1. Progress Report, Milk Waste Research, 1948, Report No. 7-1-48, Committee on Industrial Waste, Research Council of Ontario, October 1948.

and protection of fish and wildlife. The State of New York provides an example of how this can be done. Although its water problems are more complex than those of the Province of Ontario, it has already -

(a) set up a Water Pollution Control Board.

(b) adopted a classification of waters for particular uses and a set of standards of quality and purity which are to be applied to them.

The present classification there includes seven classes of fresh water based upon its destined use, such as drinking, culinary processes, agricultural uses, bathing, fishing and industrial uses.

Control of new outlets is extremely important. Article 6 of the Public Health Act, State of New York, reads in part:

> "After the effective date of this article, any person desiring to make...any new outlet for the discharge of sewage, industrial waste or other wastes...into the waters of this state, shall first make application to the board for a permit to construct and use such outlet. If, after hearing, the board finds that the discharges from such proposed outlet will not be in contravention of the standards adopted by the board, such permit shall be issued to such applicant, so conditioned as the board may direct."

A similar control of all new outlets in Ontario appears to be the logical first step. When and if it is completed the second step of controlling the present outlets will have a greater chance of success, particularly if a set of water standards is established, based on the intended use.

The dams recommended for construction near Nithburg and Ayr would noticeably increase the summer flow of the river. They would help to reduce the effects of the present pollution and to improve conditions for fish, but the need for rigid control of existing and new industrial and domestic pollution outlets will remain.

7. <u>Fish Distribution</u>

(a) <u>The River</u>

The Nith is still fairly productive of fish. The following list includes 43 species taken in the river during the survey.

LIST OF FISHES OF THE NITH WATERSHED[1]

(Based on collections during the 1949 survey)

*Brown trout	Salmo trutta Linnaeus
*Eastern speckled trout	Salvelinus fontinalis (Mitchill)
*Common white sucker	Catostomus commersonnii (Lacépède)
Hogsucker	Hypentelium nigricans (Le Sueur)
*Northern redhorse	Moxostoma aureolum (LeSueur)
Carp	Cyprinus carpio Linnaeus
Creek chub; horned dace	Semotilus atromaculatus (Mitchill)
Pearl dace	Margariscus margarita (Cope)
Blacknose dace	Rhinichthys atratulus (Hermann)
Longnose dace	Rhinichthys cataractae (Valenciennes)
Redbelly dace	Chrosomus eos Cope
Golden shiner	Notemigonus crysoleucas (Mitchill)
Rosyface shiner	Notropis rubellus (Agassiz)
Common shiner	Notropis cornutus (Mitchill)
Blackchin shiner	Notropis heterodon (Cope)
Blacknose shiner	Notropis heterolepis Eigenmann and Eigenmann
Pugnose shiner	Notropis anogenus Forbes
Brassy minnow	Hybognathus hankinsoni Hubbs
Fathead minnow	Pimephales promelas Rafinesque
Bluntnose minnow	Hyborhynchus notatus (Rafinesque)
*Yellow bullhead	Ameiurus natalis (LeSueur)
*Brown bullhead	Ameiurus nebulosus (LeSueur)
Stonecat	Noturus flavus Rafinesque
Mud minnow	Umbra limi (Kirtland)
*Pike	Esox lucius Linnaeus
Killifish	Fundulus diaphanus (LeSueur)
Yellow perch	Perca flavescens (Mitchill)
Blackside darter	Hadropterus maculatus (Girard)
Johnny darter	Boleosoma nigrum (Rafinesque)
Iowa darter	Poecilichthys exilis (Girard)
Rainbow darter	Poecilichthys caeruleus (Storer)
Fan-tail darter	Catonotus flabellaris (Rafinesque)
Least darter	Microperca microperca (Jordan and Gilbert)
*Small-mouth bass	Micropterus dolomieu Lacépède
*Large-mouth bass	Huro salmoides (Lacépède)
*Green sunfish	Lepomis cyanellus Rafinesque
*Pumpkinseed	Lepomis gibbosus (Linnaeus)
*Bluegill	Lepomis macrochirus Rafinesque
*Long-ear sunfish	Lepomis megalotis (Rafinesque)
*Rock bass	Ambloplites rupestris (Rafinesque)
Miller's thumb	Cottus cognatus Richardson
Muddler	Cottus bairdii Girard
Brook stickleback	Eucalia inconstans (Kirtland)

* Species of particular interest to anglers are starred.

1. The arrangement and names follow those of Dymond, J. R. A List of the Freshwater Fishes of Canada East of the Rocky Mountains. Misc. Pub #1, Royal Ontario Museum of Zoology, Toronto, 1947.

The distribution of the major game fish species in the river, based on 1949 collections, is shown on the accompanying maps. Similar maps showing records of collections for each of the 43 species of fish have been prepared and are available for reference. Further collecting or angling may be expected to increase the known range of some of the species. Some species, e.g. speckled trout, are more difficult to catch than others. Smaller and younger fish are also more numerous and easier to catch than larger or older ones. Hence the map does not provide a close estimate of the relative numbers of the different species or of the locations where fish of legal size will be found. Small-mouth bass and rock bass are well distributed through most of the warmer waters south of the C.P.R. line which passes through Milverton. Large-mouth bass were recorded only in ponds on Alder Creek and Cedar Creek and its tributaries and in the creek north of Paris. Speckled trout were taken at 19 stations on 11 tributaries, the chief of these being Mannheim Creek, Alder Creek and Cedar Creek. Brown trout were taken in only 2 streams. Creek chub were very abundant, and were taken at 160 stations. The common white sucker was widely distributed, being taken at 143 stations. Hogsuckers and redhorse suckers were also common[1]. Of the three species of catfish none was taken at more than 4 stations. Pike were taken at only 6 stations, all at the south end of the watershed, but this species is often missing in seine collections at places where it can be taken by angling. Most of the remaining species belong to the minnow and perch families and are not of interest to anglers, except as they furnish food for other species or compete for it.

Extensive introductions of speckled trout (chiefly yearlings) have been made by the provincial Department of Lands and Forests, e.g., into Mannheim Creek every year

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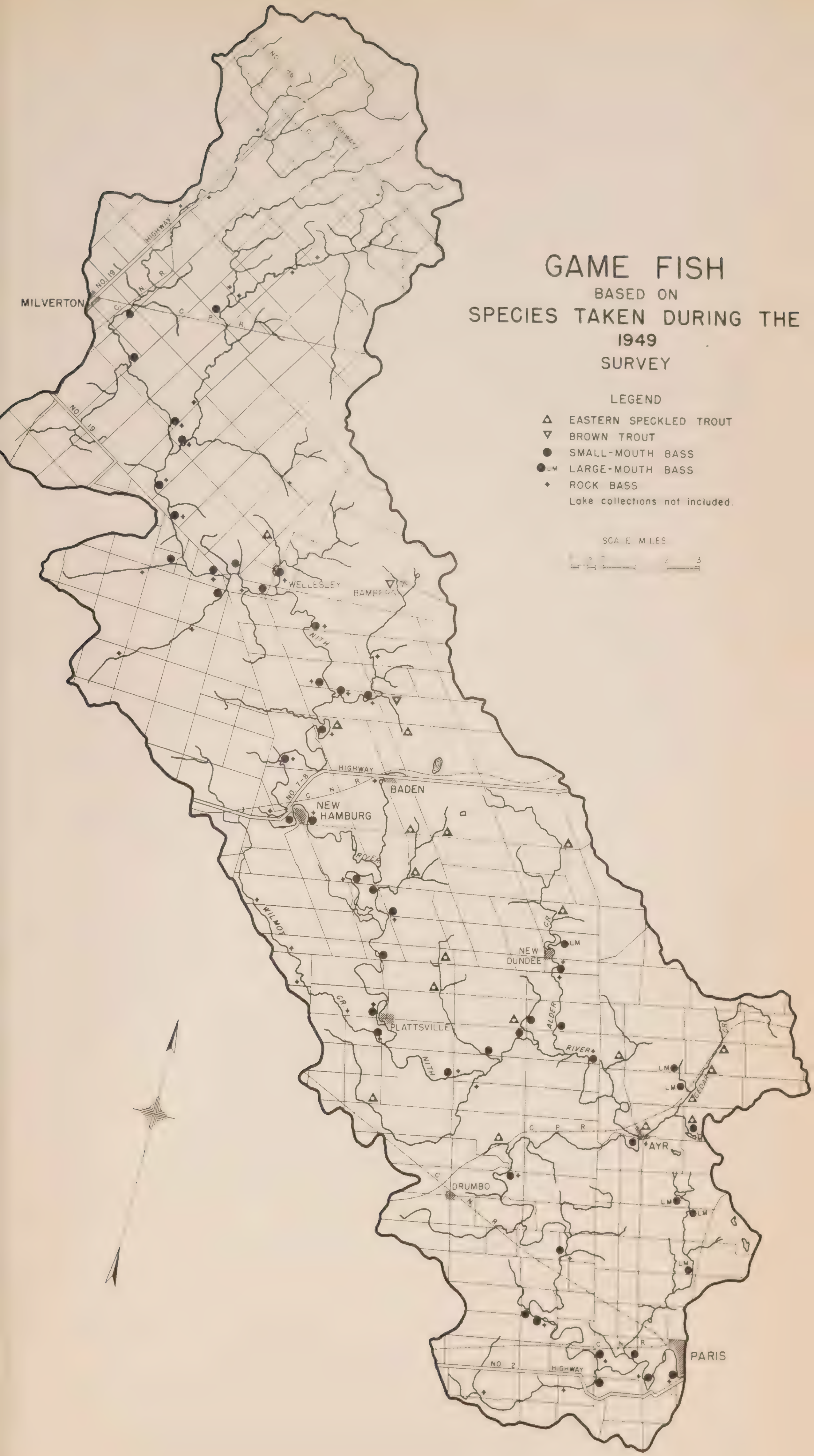
1. Forty-seven large redhorse suckers were taken in a total of six short seine hauls on the main river in August 1949. In the same hauls only three common suckers were taken.


GAME FISH
BASED ON
SPECIES TAKEN DURING THE
1949
SURVEY
LEGEND
EASTERN SPECKLED TROUT
BROWN TROUT
SMALL-MOUTH BASS
LM LARGE-MOUTH BASS
ROCK BASS
Lake collections not included.
MILVERTON
HIGHWAY
NO. 19
C. N. R.
C. P. R.
WELLESLEY
NITH
HIGHWAY
C. N. R.
BADEN
NO. 7-8
NEW HAMBURG
RIVER
WILMOT
NEW DUNDEE
ALDER
CR.
PLATTSVILLE
NITH
RIVER
CEDAR CR.
C. P. R.
AYR
DRUMBO
C. N. R.
PARIS
NO. 2
HIGHWAY

since 1933 and into Cedar Creek in most years since then. Bamberg Creek and the Gettling stream have also been stocked with speckled trout. Brown trout have been introduced into the New Dundee Pond and into Bamberg Creek. Small-mouth bass have been introduced into the main Nith regularly in large numbers and also into Hofstetter Lake. Fifty thousand pickerel (pike-perch) fry are reported to have been introduced into the main Nith in 1928. The Nith has also been stocked with muskellunge repeatedly since 1939. The muskellunge and pickerel introductions do not appear to have been successful. Neither species is common in the river, and none of either species was collected during the survey.

(b) Lakes and Ponds

Several small lakes and ponds occur on the watershed. Some of these are natural ponds but most are artificially created, such as mill ponds. In Table IV are listed some of the characteristics of these bodies of water including the fish of special interest to anglers found in them.

8. Recommendations for Improvements

Of all the phases of conservation, stream improvement requires the greatest measure of co-operation, since the manner in which watercourses are managed up stream so radically affects all the owners down stream. The cold spring-fed tributaries could be protected and the influence of the springs extended down stream by further planting of trees for shade around the sources and along the banks. Alders are the most useful trees for this purpose. There should result a considerable increase in the range of the speckled trout in the watershed.

The accompanying Stream Conditions map shows that there are already more than fifty miles of stream course (in the Nith Watershed) which can support speckled trout.

Individual owners of some of these tributaries could improve them for trout by constructing ponds near the sources, confined at present to the sections of the tributaries

coloured blue on the map. Many small pools could be developed in the sections of the tributaries below the trout range by means of low dams, partial dams or deflectors. In this way property owners can greatly improve both the appearance and use of the streams passing through their land. Wherever bank erosion occurs it should be arrested by willow or alder plantings, by concrete or masonry retaining walls or by cribbing.

(a) Farm Fish Ponds

Few of the farm fish ponds now existing on the Nith Watershed produce a useful yield. There is ample room for improvement of this type of fishing.

The chief research on management of farm fish ponds has been carried on in southern and warmer climates, and therefore the findings cannot be applied without qualification to an area having the climate of Southern Ontario, but some definite recommendations may be made. The most favourable locations for the construction of farm ponds in the watershed are shown on the map of Pond Regions in the Farm Ponds section of this report. Suitable methods for the construction of six types of farm pond are also given in that section.

From the fisherman's point of view, farm ponds are of two main kinds[1]. The first is the cool pond with continuous inflowing water and maximum temperatures at the surface of about 75° Fahrenheit with cooler bottom. Ponds of this type are usually successful near the headwaters and may range in size from about an acre to 8 or 10 acres. Depth should be 10 feet or more in the deepest part. Spring flow of as low as half a cubic foot per second will maintain a pond of one acre. This type of pond is best adapted to the production of speckled trout or brown trout. These species of trout do

1. An excellent handbook on the details of construction and management of farm fish ponds is "Fish Ponds for the Farm" by F. C. Edminster, published by Charles Scribners Sons, New York 1947. Some of the above information is abstracted from this bulletin.

LAKES IN THE NITH WATERSHED

Lake	Township	Area in Acres	Depth in ft.		Temperature (° Fahrenheit)		Bottom Type	FISH SPECIES					
			Maximum	Average	Surface	Minimum		Largemouth Bass	Smallmouth Bass	Speckled Trout	Brown Trout	Pike	Bullhead
Bamberg Lake	Wellesley	8	32	15	79	52	Mk	x					
Twin Lake (large)	Dumfries	10	30	20	77	55	Ma	x		x			
Twin Lake (small)	Dumfries	3	11	8	74	70	Ma	x					
Tanners Lake	Dumfries	13	10	8	80	68	Mk						
Turnbull's Lake	Dumfries	15	10	8	78	72	MkMa	x				x	x
Lester Lake	Dumfries		30	20	73	57	Mk	x					
Spottiswood Lake	Dumfries	35	6	2	90	-	MkMa	x					
Upper Spottiswood Lake	Dumfries	4	30	25	83	50	Cl	x					
Long Pond Lake	Dumfries	5	35	24	88	55	Mk						
Baden Pond	Wilmot	4	8	5	73	-	Mk		x				
Hofstetter Lake	Wilmot	10	35	10	81	49	Det	x					x
Levey Lake	Blenheim	4	6	4	85	79	Ma					x	
Cedar Creek Pond	Dumfries	1	16	8	80	63	Mk	x	x		x		x
New Dundee Pond	Dumfries	3	12	7	78	70	Mk	x					

Mk - Muck Cl - Clay
Ma - Marl Det - Detritus

Surface and bottom temperatures were taken on various dates in August 1949

not normally reproduce in ponds and must be maintained by periodic restocking. Ponds cold enough for trout should be stocked only with trout and the two species of trout should not be mixed. Speckled trout fingerlings should be stocked at the rate of about 3,000 per acre.

The second and commoner type of farm pond is the warm water pond. Most farms have at least one low spot suitable for a fish pond. It is frequently good practice to have separate ponds devoted to wildlife and fish and to control the aquatic plants in the fish pond.

In managing warm water ponds for fish the following points should be kept in mind.

(1) A minimum depth of 10 feet over at least 25 per cent of the pond should be planned to avoid excessive winter kill, probably the critical factor in fish survival in farm ponds in Ontario.

(2) If suckers, carp or large numbers of minnows are already present in the pond, it is usually best to destroy all fish in the pond.

(3) It is often necessary to control existing aquatic vegetation. There are both mechanical and chemical methods available[1].

(4) There have been few tests made in Ontario of the efficiency of applications of fertilizer in increasing the crop of plankton, the smaller aquatic invertebrates. The research now being carried out in this field may lead to application of fertilizers such as 8-8-4 becoming more general.

(5) Stocking of fish is necessary in most ponds. Warm water ponds may be stocked to the best advantage, after destroying the previous fish, with a combination of large-mouth bass (_Huro salmoides_) and bluegills (_Lepomis machrochirus_ at the rate of 100 bass per acre and 1,000 bluegills per acre. Fishing must be deferred until some of each species have spawned successfully.

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1. Speirs, J. Murray. Summary of Literature on Aquatic Weed Control. Canadian Fish Culturist, 3:(4); August 1948.